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ADDENDUM NO. 1

Date: September 29, 2011
Project: Cedarvale Community School Classroom and Gymnasium Addition
Project No.: 1108

Part One: General

1.1 All clauses set forth in the General Conditions of the contract documents shall apply to and govern this work.

1.2 This addendum refers to changes and additions to the original contract documents and is to be read in conjunction with the same. All other parts of the original contract documents are to be considered as applying to the work of this contract with the exceptions of the changes noted below.

1.3 No consideration will be allowed for extras to the contract due to the contractors, or subcontractors, not being familiar with this addendum.

1.4 TENDER PRICE SCHEDULE

Add Cash Allowance 1.7:
New transformer, hydro connection and shut downs by Toronto Hydro **$105,000.**

Revise Separate Price 2.2 to read:
Removal of existing play structure in courtyard and storage until ready for installation
as per Site Hoarding Plan 1/A1.01b, Issued for Permit and Tender, dated September 6, 2011.

All landscaping work at south of the building only as per Landscape drawings, Issued for Tender, dated September 6, 2011- which includes the following:

1. Asphalt paving and line painting
2. Tree protection
3. Timber work, chain link fences and gates
4. Removal of existing dome play structure
5. Site preparation and surfacing for relocated play equipment from courtyard
6. Installation of relocated play equipment from courtyard
7. Installation of relocated dome play structure
8. Timber retaining wall around relocated dome play structure
9. Relocation of basketball hoops (2)
10. Sod restoration

Convert Itemized Price 3.1 to Separate Price 2.4
Millwork shelving units MW114-1, MW115-1, MW116-1.

Convert Itemized Price 3.2 to Separate Price 2.5
Supply and planting of new trees (4 next to parking lot, 2 in courtyard)

TENDER PRICE SCHEDULE (Cont'd)
Add Separate Price 2.6:
Supply and installation of stone seating in Courtyard as indicated on Landscape Drawings.

Add Separate Price 2.7:
To provide 100 metres of ornamental metal fencing and 1 pedestrian gate at south end of site with detail per Landscape drawing 5/L06, dated September 6, 2011.

Add Itemized Price 3.1:
Supply and installation of Divider Curtain in Gymnasium as indicated on drawings and specified in Section 11480.

Delete Itemized Price 3.3.

Add Alternate Price 4.5:
Delete precast base and provide parged concrete foundation at all conditions under typical block veneer and curtain wall conditions. Provide stack bond concrete block CB-3 in lieu of precast panels at locations under aluminum windows at classroom addition.

1.5 SUPPLEMENTAL INSTRUCTIONS
Add the following paragraphs to the end of Section 11a) SCHEDULE:

Work shall begin immediately after the Contract is awarded with the exception of the Work described below:

Work affecting the existing school operations including but not limited to: electrical shutoff, sprinkler installation in existing school corridor, landscaping outside hoarded areas and all classroom renovation work including tie ins at the existing school- shall take place on during the following school closures (inclusive dates):

Christmas holidays:	December 24, 2011 to January 8, 2012.
Family day long weekend:	February 18 to February 20, 2012.
March Break:	March 10 to March 18, 2012.
Easter long weekend:	April 6 to April 9, 2012.
Summer vacation:	June 30 to August 16, 2012.

1.6 DOCUMENT 00810 – SUPPLEMENTARY ARTICLES, DEFINITIONS, CONDITIONS
Revise 6.2.4:
General Contractor's combined overhead and profit mark-up on Subcontractor work shall not exceed 10%.

Part 2: Architectural Specification Revisions

2.1 SECTION 00010 – TABLE OF CONTENTS
Add: – Chemical Testing Results to heading 00200.
Delete: SECTION 07535 – TPO MEMBRANE ROOFING (Alternate)

2.2 SECTION 00200 – INFORMATION AVAILABLE TO BIDDERS
Add attached Chemical Testing Results (9 pages).

2.3 SECTION 02725 – SITE STONEWORK
Add 'and photos' *after* 'Provide shop drawings' *in 1.08.C.*

Delete the word 'Preferred' *2.02.*

Add to the end of 2.02.A: 'or approved equal'.

Add (ST-1): Limestone
Stone at gymnasium low window sills as indicated on Exterior Elevations.
"Indiana Limestone" supplied by Owen Sound Ledgerock Limited or approved alternate.
Colour: Slight silver underfleck to provide surface variety.
Finish: buff and smooth
Joints: minimize joints. Indicate all joints on Shop Drawing. Provide mitre joints at corner conditions.

2.4 SECTION 04200 - MASONRY
Add to 2.1 (CB-3): 'Rutherford' Ground Face Masonry Units Trendstone by Trenwyth

Add 2.2.1.7 'F.A.S.T. Bracket' by Fero Corporation for veneer support on existing masonry wall

2.5 SECTION 05310 - METAL DECK
Add 2.1.5:
The Miscellaneous Metals supplier (Section 05500) shall provide channel supports to the metal deck installer (05310) for installation within flute above the deck. Spacing shall be as directed by the Consultant on site. Refer to Roof Types on Sheet A0.02.

2.6 SECTION 06200 – FINISH CARPENTRY
Add to the end of section attached Millwork Schedule dated, September 29, 2011.

Revise 2.1.10.3.2 (SOL-2) to Corian's Willow (Terra Collection) by Dupont

Delete in 2.2.2.2: 'with 25mm overtravel; Accuride 3640'.

2.7 SECTION 08700 – FINISH HARDWARE
Add to the end of section:
Schedule of Finishing Hardware dated, September 16, 2011.

2.8 SECTION 00880 – GLAZING

Revise 2.2.2: Fire rated glass (GL-3):
45 min fire rating tested to ULC CAN4 S104-M and ULC CAN4 S106-M, 19 mm thick or as otherwise noted on Interior Glazing Schedule with appropriate labeling stating fire rating and approval, clear polished glass. 'Pyrostop 45-200' by Pilkington or approved alternate.

Revise 2.2.3: Fire rated glass (GL-4):
1 hr. fire rating tested to ULC CAN4 S104-M and ULC CAN4 S106-M, 19 mm thick or as otherwise noted on Interior Glazing Schedule with appropriate labeling stating fire rating and approval, clear polished glass. 'Pyrostop 60-101' by Pilkington or approved alternate.

Revise 2.2.4 Spandrel glass (GL-6): CAN/CGSB-12.9-M, 6mm thick unless otherwise indicated, tempered ceramic frit spandrel glass with ceramic frit coating applied to backside. Ceramic frit colour: allow for two colours selected by the Consultant from Benjamin Moore, screen transferred to glass surface and heat cured. 'V911' by Viracon or approved alternate.

Add 2.2.6 Insulated Glass Unit (SU-4): GL-6 inside, air space, GL-1 outside (low-E coating), for use at all spandrel glass units at Classroom Addition.

2.9 SECTION 09250 – GYPSUM BOARD

Revise designation (GB-2) to VHI Fiberock Abuse-Resistant Panel by CGC.

Revise designation (GB-4) from 'Dens-Glass Gold Fireguard' to 'Dens-glass Sheathing'.

Add designation (GB-8) Cement Board.

2.10 SECTION 09620 – ATHLETIC FLOORING

Add to the end of 2.1.7:

Field colour:	'504' Stone Grey
Painted line colours:	PTL-1 – Black
	PTL-2 – Signal Blue
	PTL-3 – Ruby Red

2.11 SECTION 09660 – RESILIENT TILE FLOORING

Add Rubber base (B-3): Vented cove base perimeter base: 8mm thick x 76mm x 99mm ventilating type; Allow for 2 different colours by Consultant. 'Vented Cove Base' by Johnsonite or approved alternate.

*Revise 2.1.1.1.1 (*VCT-1) from 51800 'Buttercream Yellow' to 51822 'Cumulus Blue'.
Add to the end of 2.1.6: Level flooring at all hollow metal frames.

2.12 SECTION 11480 – GYMNASIUM EQUIPMENT

Revise 2.1.6.1 Curtain Track:
Standard duty straight track for manually-operated bi-parting curtain, complete with typical track connections, all necessary accessories, continuous operating lines, end pulleys and ball bearing floor pulleys; Model No. 101A by H&H or equivalent by Janson Industries.

SECTION 11480 – GYMNASIUM EQUIPMENT (Cont'd)
Delete 2.1.6.2 Curtain Winch.

Revise 2.1.6.3 Curtain Fabrication:

.1 Fabrics shall be product of Janson Industries or approved alternative.
.2 All fabrics shall be flameproofed by vat immersion process or shall be woven from inherently flame resistant fibers. The flameproofing shall accord with standard industry practice and the requirements of all local, state and national authorities. The contractor shall supply evidence of compliance. Attach test panel to bottom hem.
.3 Curtain shall be manufactured from 54 inch cotton velour, weighing 21 ounces per running yard (to later selection by Consultant from standard range of colours).
.4 Fabrics shall be from the same dye lot to ensure consistency of colour.
.5 Seams shall be sewn and surged to prevent fraying.
.6 All cuts shall run full height. Cross cuts are not permitted.
.7 Stage curtain assembly to be complete with all accessories and components as required for complete and secure installation.
.8 Refer to drawing 2/A5.01 for dimensions.

Part 3: Architectural Drawing Revisions

3.1 SHEET A0.02 – TYPES, ABBREVIATIONS & SCHEDULES
Revise Material Abbreviations as per ASK.17 attached, dated September 29, 2011.
Revise Room Finish Schedule as per ASK.17 attached, dated September 29, 2011.
*Revise Threshold Type **THR-1** as per ASK.17 attached, dated September 29, 2011.*
*Revise Wall Type **W-2** as per ASK.16 attached, dated September 29, 2011.*
*Revise Roof Type **R-1** as per ASK.16 attached, dated September 29, 2011.*
*Revise **F-3** and add **F-3A** to Furring Types as per ASK.16 attached, dated September 29, 2011.*

3.2 SHEET A0.03 – FR PROFILES, DOOR TYPES & SCHEDULE
Revise Door Schedule as per ASK.19 attached, dated September 29, 2011.
Revise Door Type 4 as per ASK.19 attached, dated September 29, 2011.
Revise Hollow Metal Frame Profile as per ASK.18 attached, dated September 29, 2011.
Revise Interior Glazing Schedule as per ASK.20-23 attached, dated September 29, 2011.

3.3 SHEET A0.04 – AL FRAME PROFILES
Add ALF types, as per ASK.24-25 attached, dated September 29, 2011.

3.4 SHEET A0.05 – AL FRAME PROFILES & EXTERIOR GLAZING SCHEDULE
Add full sheet attached, dated September 29, 2011.

3.5 SHEET A1.01b – DEMOLITIONS PLANS
Revise Partial Demolition Plan 5 as per ASK. 31 attached, dated September 29, 2011.

3.6 SHEET A2.01 – GROUND FLOOR PLAN - GYMNASIUM
*Revise plan: **F-3A** on lower portions of existing East and South masonry walls of Gymnasium as per ASK.28 attached, dated September 29, 2011.*

3.7 SHEET A2.05 – FLOOR FINISH PLAN – GYMNASIUM
Add full sheet attached, dated September 29, 2011.

3.8 SHEET A2.06 - FLOOR FINISH PLAN – CLASSROOM
Add full sheet attached, dated September 29, 2011.

3.9 SHEET A3.01 – REFLECTED CEILING PLAN - GYMNASIUM
Delete light fixture F11 from Light Fixture Legend.

3.10 SHEET A3.02 – REFLECTED CEILING PLAN - CLASSROOM
Delete light fixture F11 from Light Fixture Legend.

3.11 SHEET A4.01 – EXTERIOR ELEVATIONS
Revise Elevation 1 and 6 per ASK.05 attached, dated September 26, 2011.
Revise Elevation 5 per ASK.09 attached, dated September 26, 2011.

3.12 SHEET A5.54 – WALL SECTIONS
Add Wall Section 1, as per ASK.11 attached, dated September 26, 2011.

3.13 SHEET A6.02 – PLAN DETAILS
Revise Plan Detail 4, as per ASK.10 attached, dated September 26, 2011.

3.14 SHEET A6.53 – SECTION DETAILS
Add Section Detail 3, as per ASK.06 attached, dated September 26, 2011.
Add Section Detail 7, as per ASK.07 attached, dated September 26, 2011.
Add Section Detail 9, as per ASK.13 attached, dated September 26, 2011.

3.15 SHEET A6.54 – SECTION DETAILS
Revise Section Detail 4, as per ASK.14 attached, dated September 26, 2011.

3.16 SHEET A6.59 – SECTION DETAILS
Add Section Detail 5, as per ASK.01 attached, dated September 29, 2011.

3.16 SHEET A8.01 – INTERIOR ELEVATIONS
Revise Interior Elevation 14 & 16, as per ASK.29 attached, dated September 29, 2011.

3.17 SHEET A8.02 – INTERIOR ELEVATIONS
Revise Interior Elevation 3 & 4, as per ASK.30 attached, dated September 29, 2011.

3.18 SHEET A9.01 – MILWORK TYPES
Add Millwork Type (J) and details as per as per ASK.02, ASK.03A, ASK.03B & ASK.03C attached, dated September 29, 2011.

3.19 SHEET A9.02 – MILWORK DETAILS
Add Millwork Details 2 as per ASK.04 attached, dated September 29, 2011.
Revise 3/A9.02 and 4/A9.02 as per ASK.26-27 attached, dated September 29, 2011.

Part 4: Civil Revisions
N/A

Part 5: Landscape Revisions
N/A

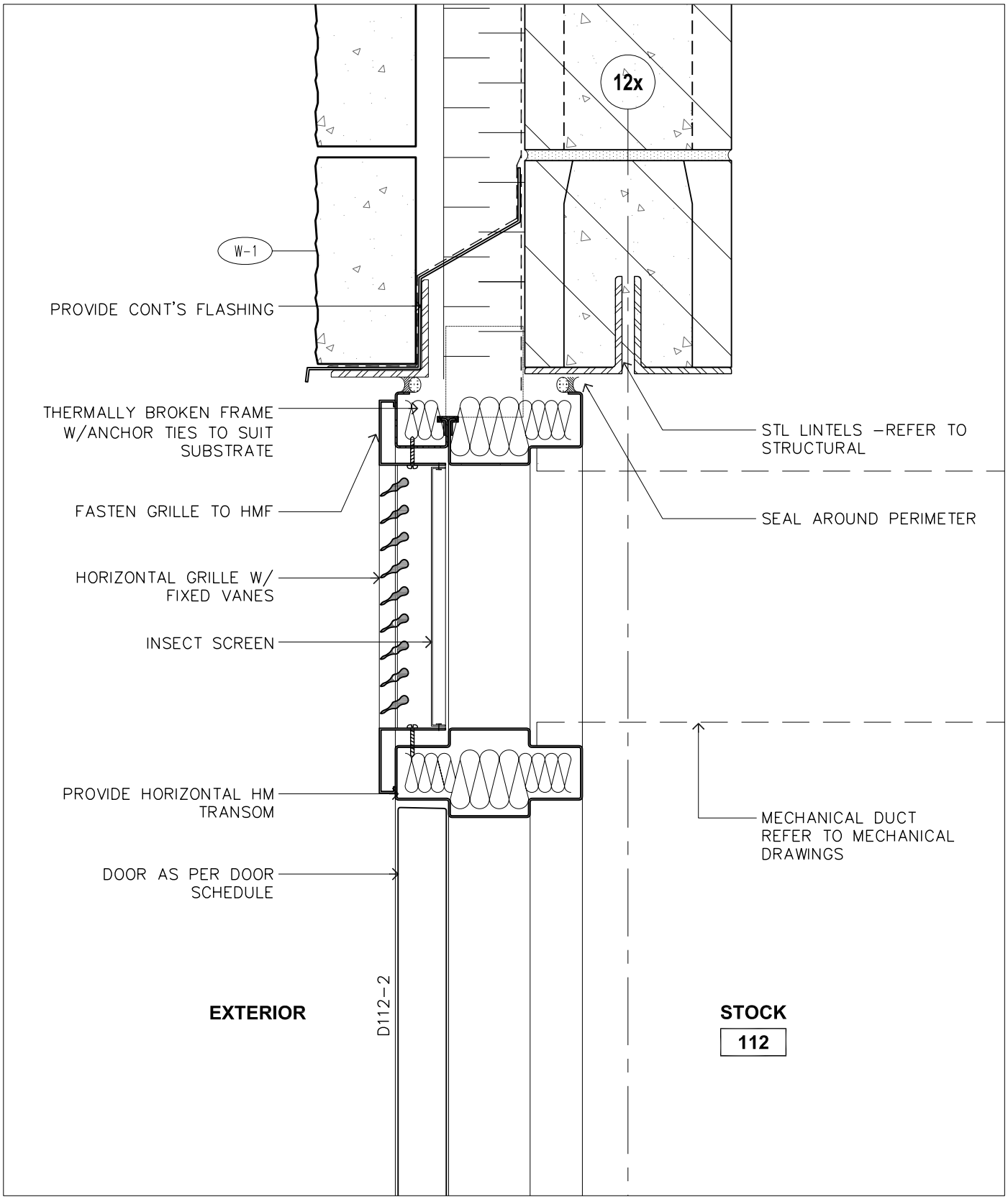
Part 6: Structural Revisions
N/A

Part 7: Mechanical Revisions
Add Mechanical Specification attached, dated September 6, 2011.

Part 8: Electrical Revisions
Add Electrical Specification attached, dated September 6, 2011.

Part 9: Communication Revisions
Add Communications Specification attached, dated September 6, 2011.

End of Addendum No. 1



1 / ASK-01 **SECTION DETAIL - PART OF 5/A6.59**

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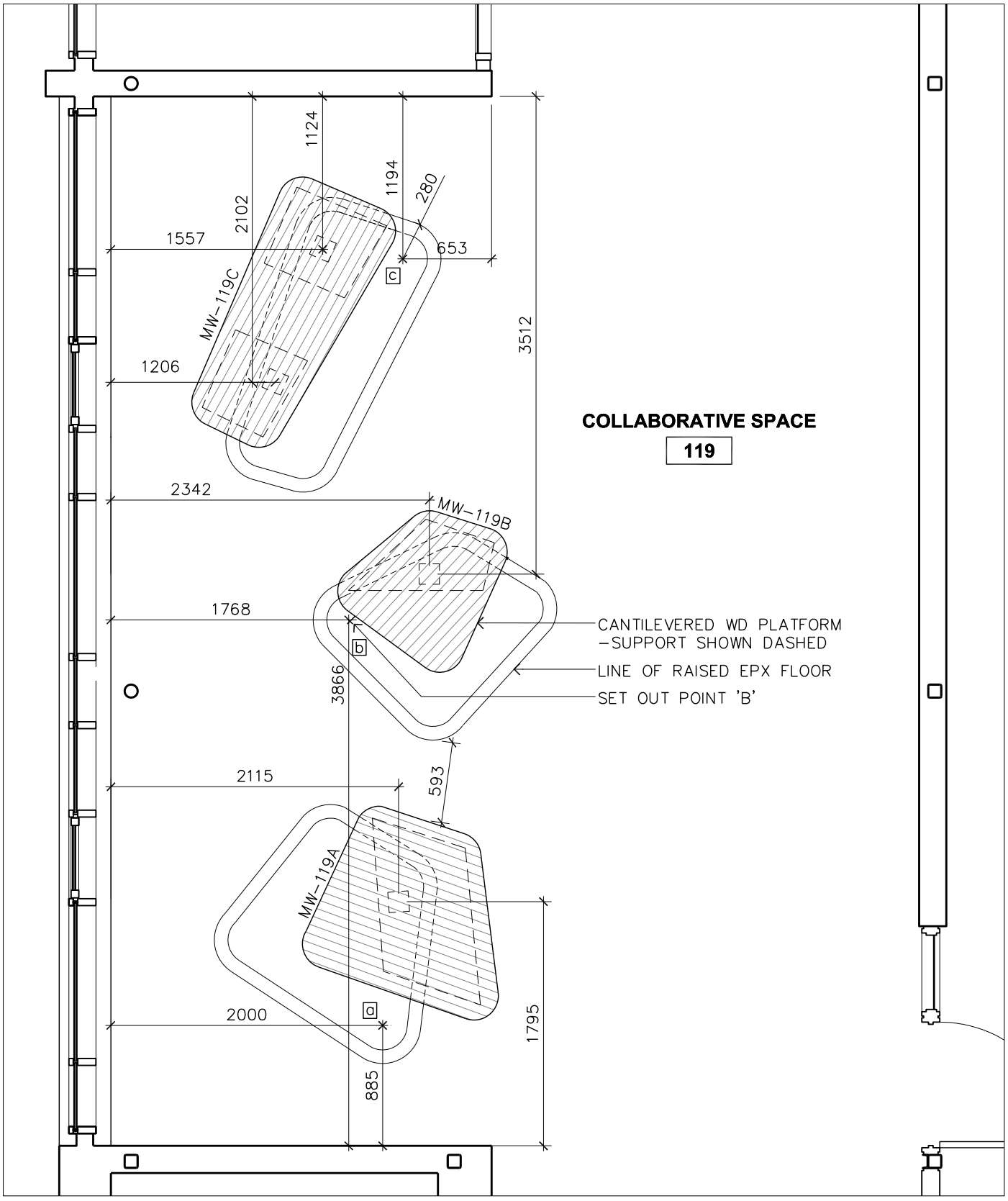
LOUVERED TRANSOM SECTION DETAIL

project no. :	1108
scale :	1:5
date :	SEPTEMBER 2011
drawn by :	MC
issued for • revision •	
revision date •	Addendum no.1 29/SEPT/2011

drawing no. :

ASK.01



1 / ASK-02 **MW-119 LOCATION PLAN**

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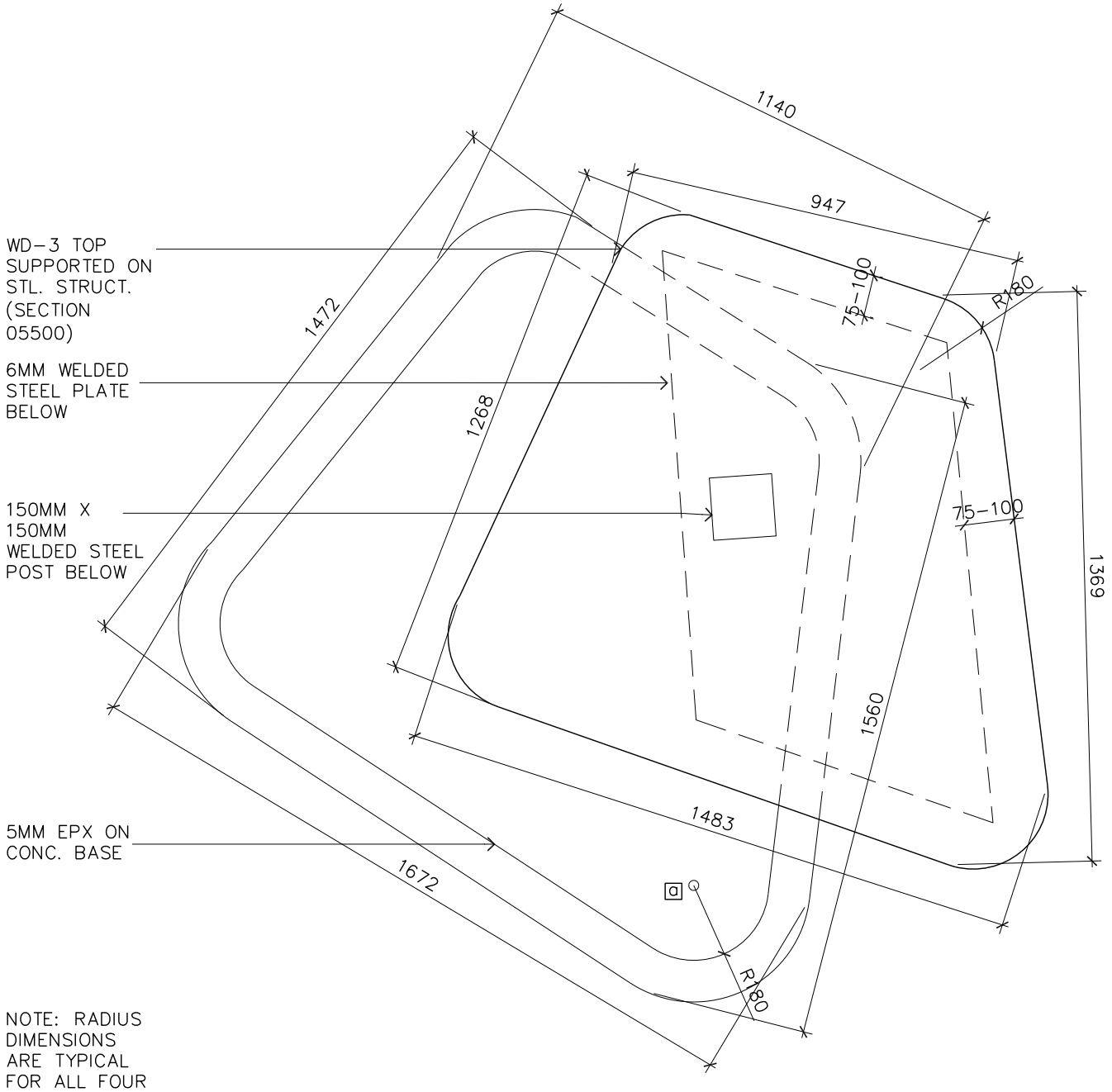
MW-119 LOCATION PLAN

project no. :	1108
scale :	1:40
date :	SEPTEMBER 2011
drawn by :	TQ
issued for :	
revision :	Addendum no.1
revision date :	29/SEPT/2011

drawing no. :

ASK.02



NOTE: RADIUS DIMENSIONS ARE TYPICAL FOR ALL FOUR CORNERS

1 / ASK-03A **MW-119A PLAN**
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MW-119A PLAN

project no. :	1108
scale :	1:15
date :	SEPTEMBER 2011
drawn by :	TQ
issued for / revision :	Addendum no.1
revision date :	29/SEPT/2011

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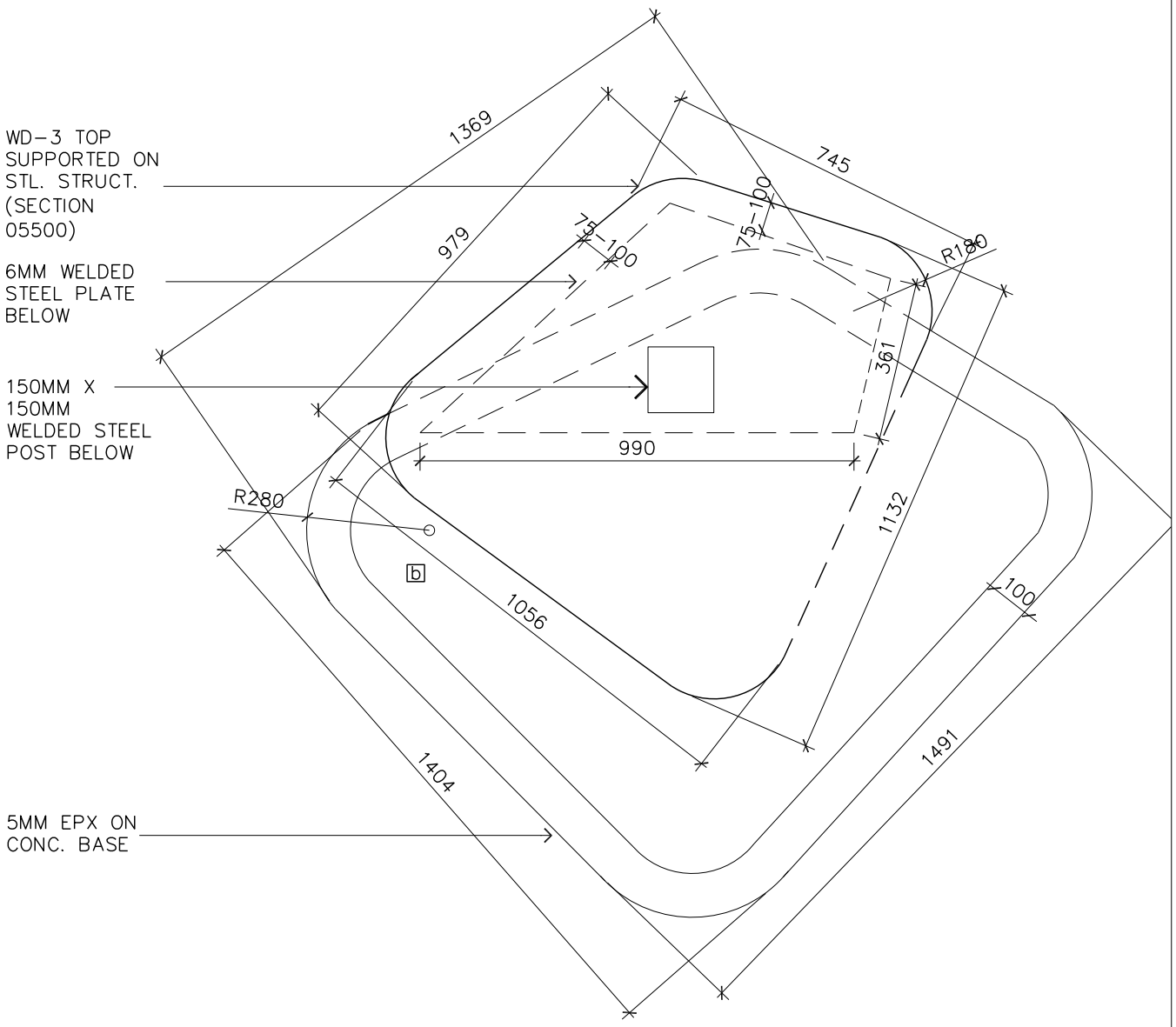

NOTE: RADIUS DIMENSIONS ARE TYPICAL FOR ALL FOUR CORNERS

1
ASK-03B

MW-119B PLAN

1:15

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MW-119B PLAN

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scale :	1:15
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drawn by :	TQ
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revision ·	Addendum no.1
revision date ·	29/SEPT/2011

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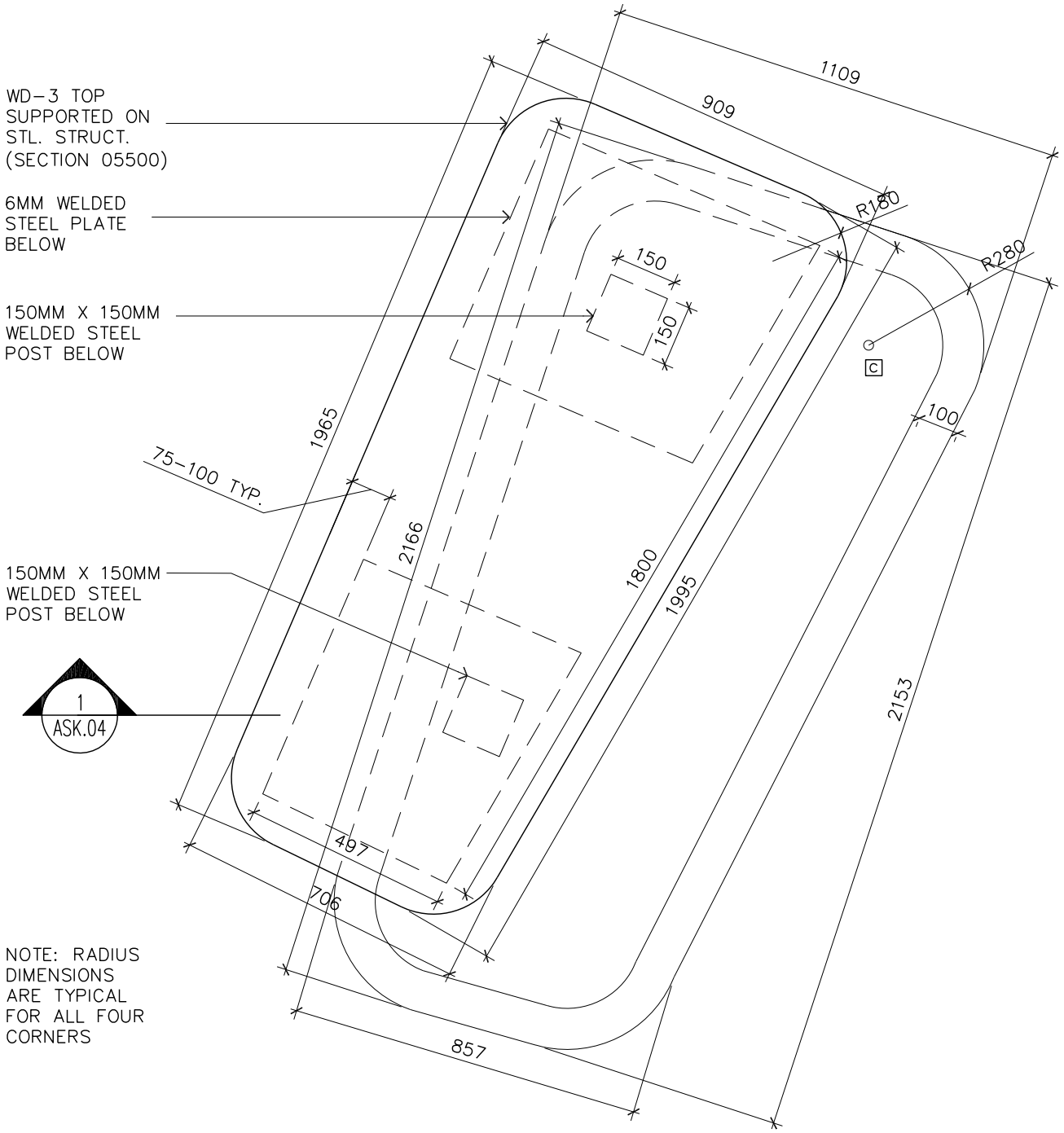

1 ASK-03C **MW-119C PLAN**

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MW-119C PLAN

project no. :	1108
scale :	1:15
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revision ·	Addendum no.1
revision date ·	29/SEPT/2011

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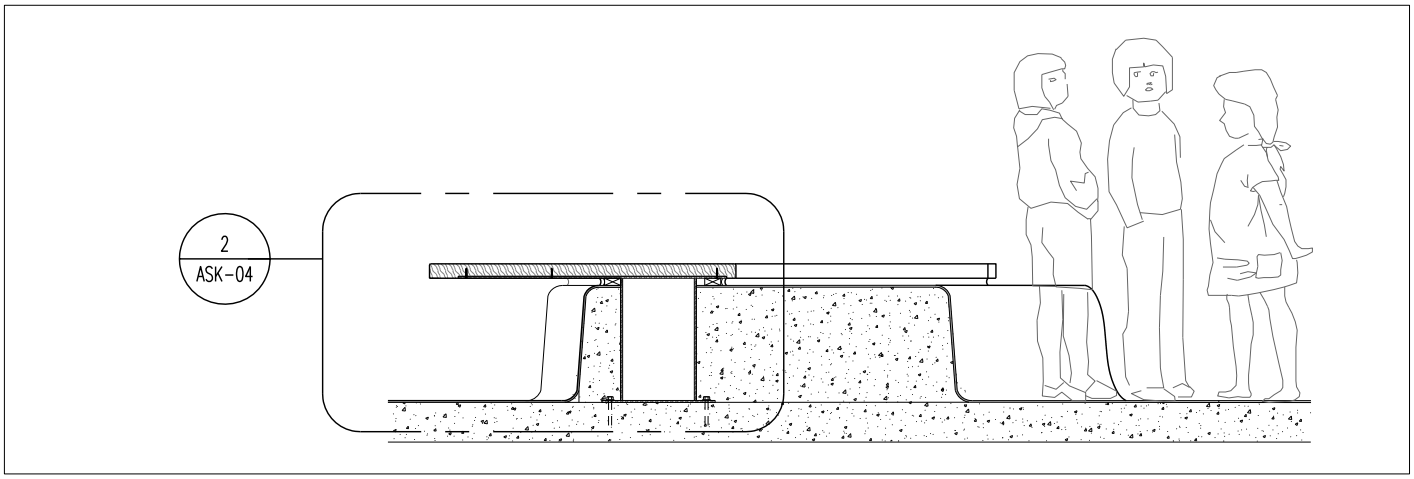

1 ASK-04 **ELEVATION**
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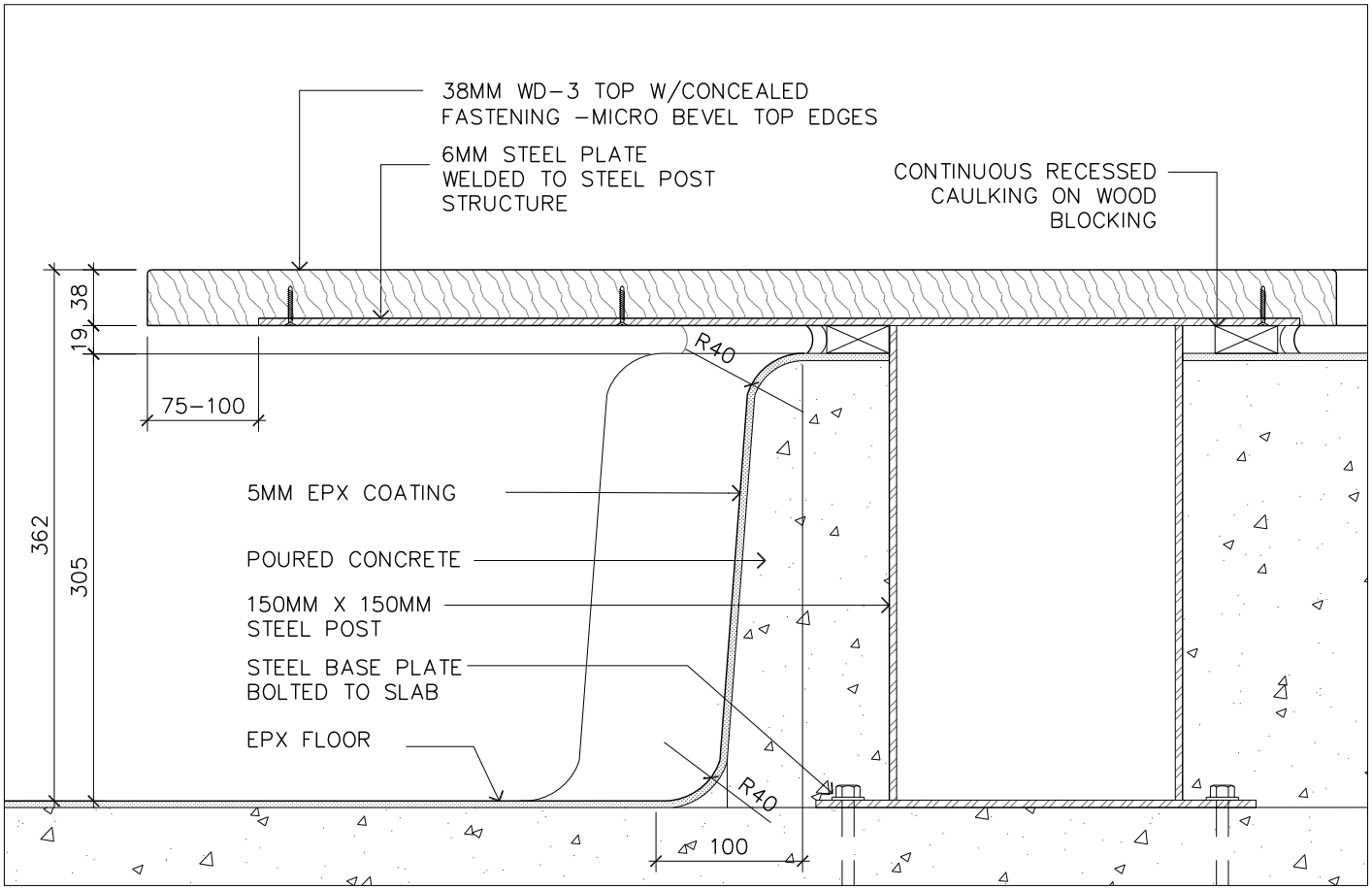

2 ASK-04 **SECTION DETAIL**
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MW-119C SECTION

project no. :	1108
scale :	1:5
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revision ·	Addendum no.1
revision date ·	29/SEPT/2011

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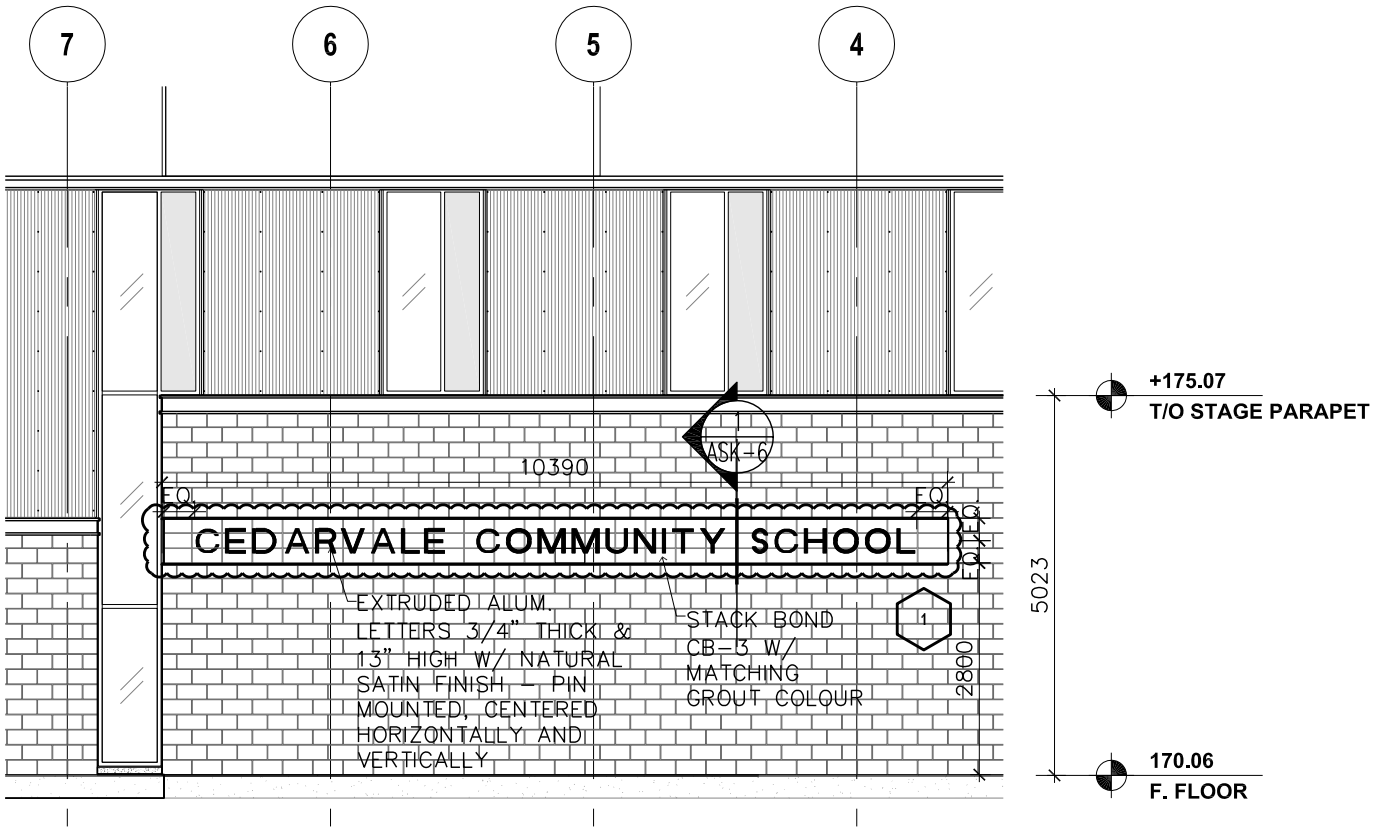
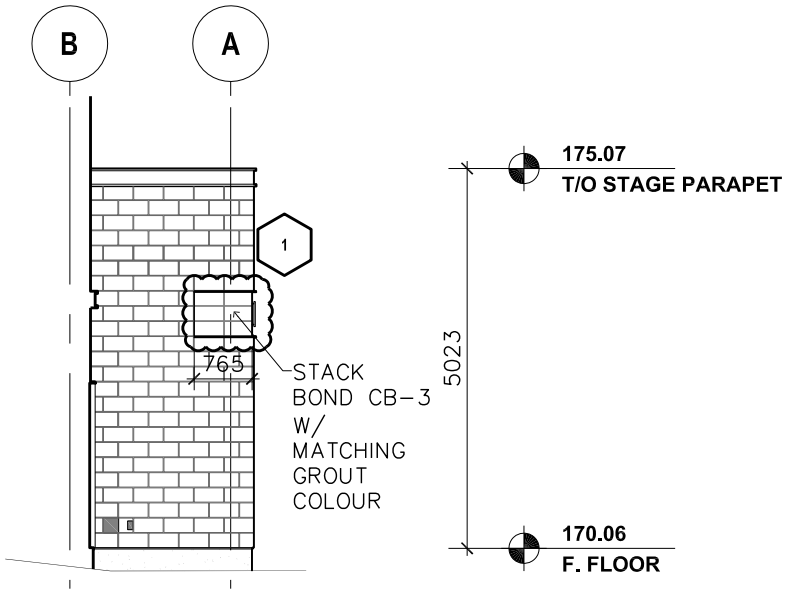


1 / ASK-05 **NORTH ELEV. - PART OF 1/A4.01**

1:100



2 / ASK-05 **EAST ELEV.-STAGE - PART OF 6/A4.01**

1:100

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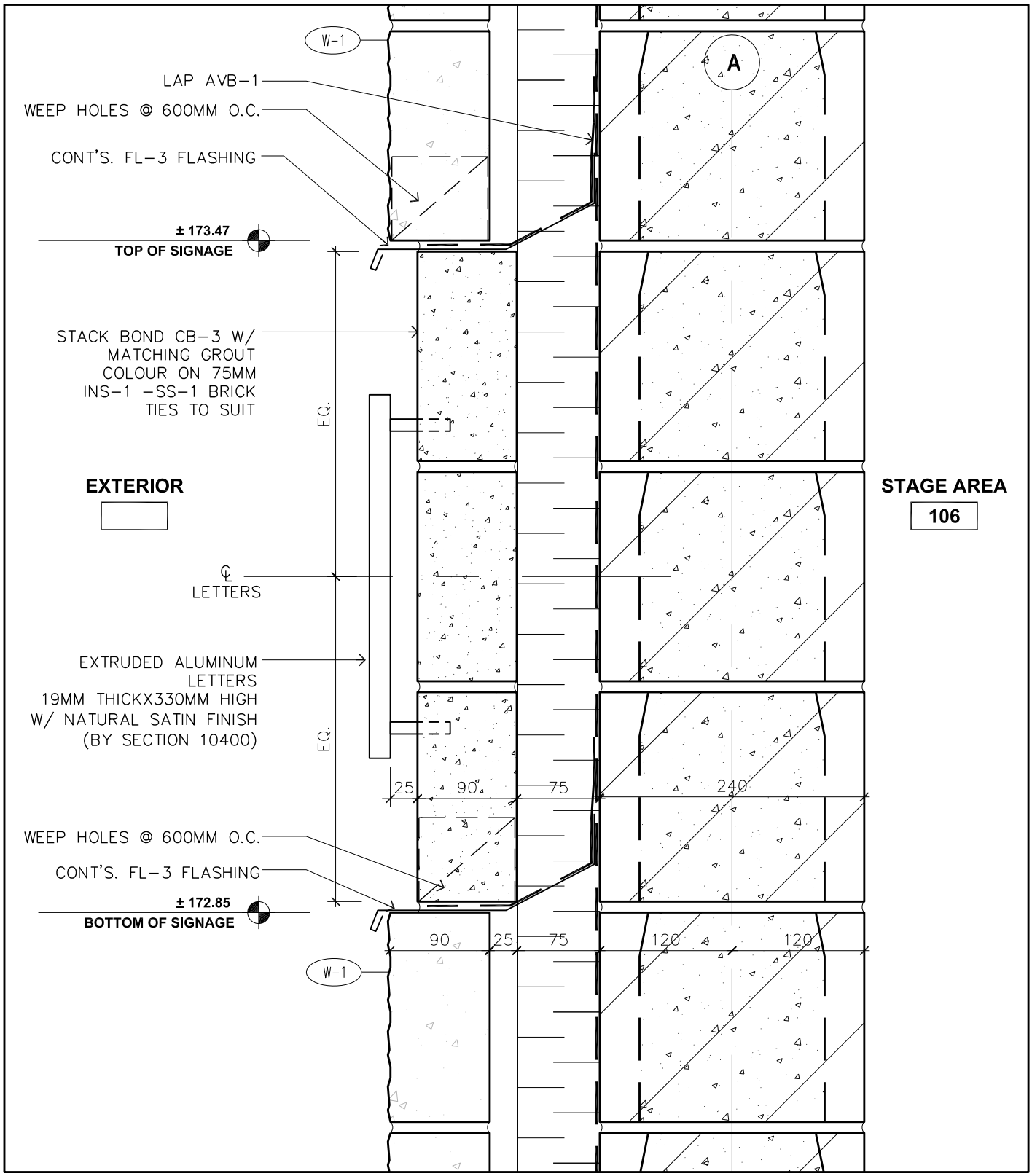
SIGNAGE ON NORTH GYM WALL EXTERIOR ELEVATION

project no. :	1108
scale :	1:100
date :	SEPTEMBER 2011
drawn by :	AG
issued for :	
revision :	Addendum no.1
revision date :	29/SEPT/2011

drawing no. :

ASK.05



1 / ASK-06 **SIGNAGE SECTION DETAIL - PART OF 3/A6.53**

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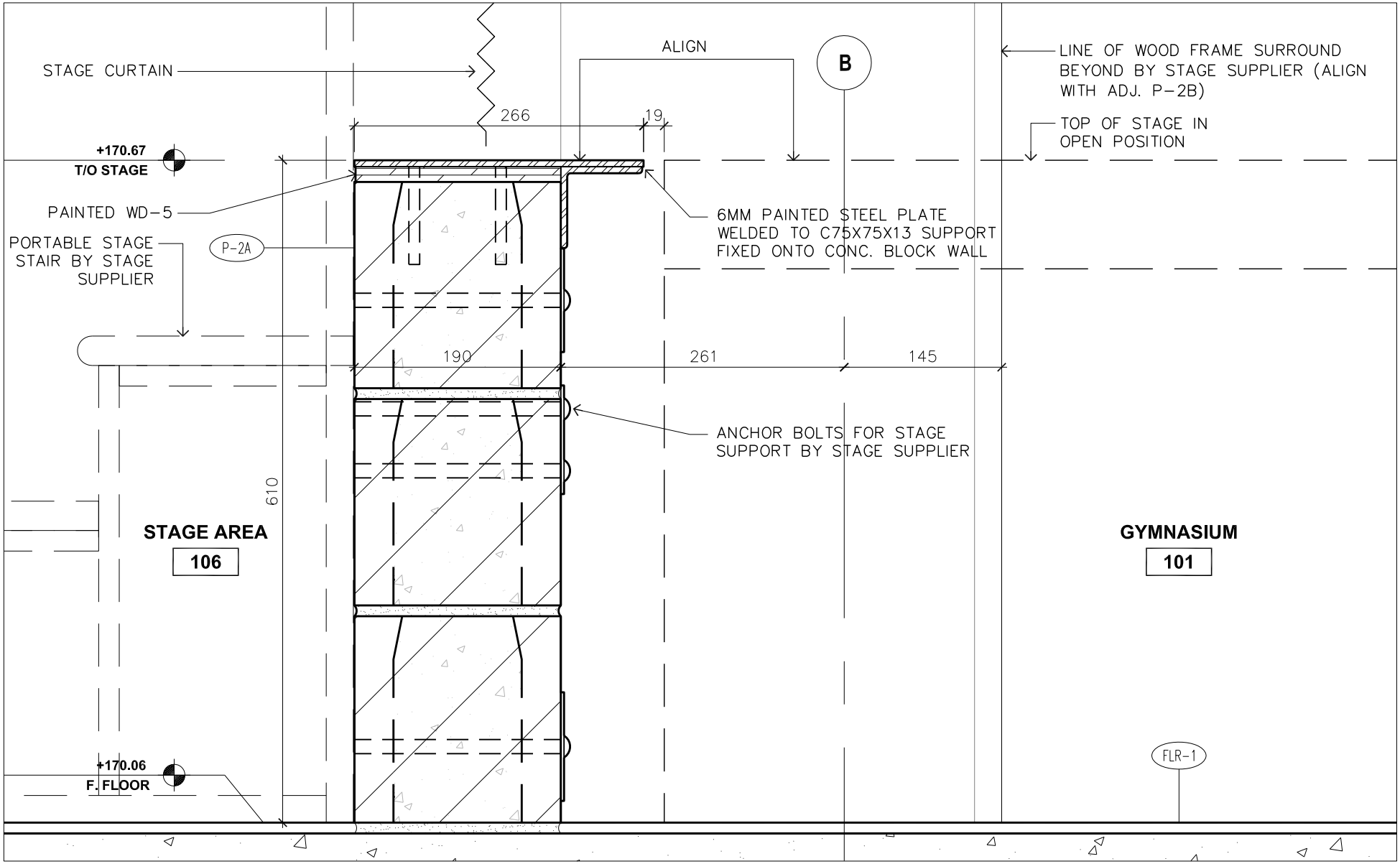
SIGNAGE SECTION DETAIL @ NORTH GYM WALL

project no. :	1108
scale :	1:5
date :	SEPTEMBER 2011
drawn by :	AG
issued for :	
revision :	Addendum no.1
revision date :	29/SEPT/2011

drawing no. : **ASK.06**



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ASK-07

SECTION DETAIL- RETRACTABLE STAGE - PART OF 7/A6.53

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CEDARVALE CS - CLASSROOM AND GYMNASIUM ADDITION

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SECTION DETAIL RETRACTABLE STAGE

project no. :	1108
scale :	1:5
date :	SEPTEMBER 2011
drawn by :	AG
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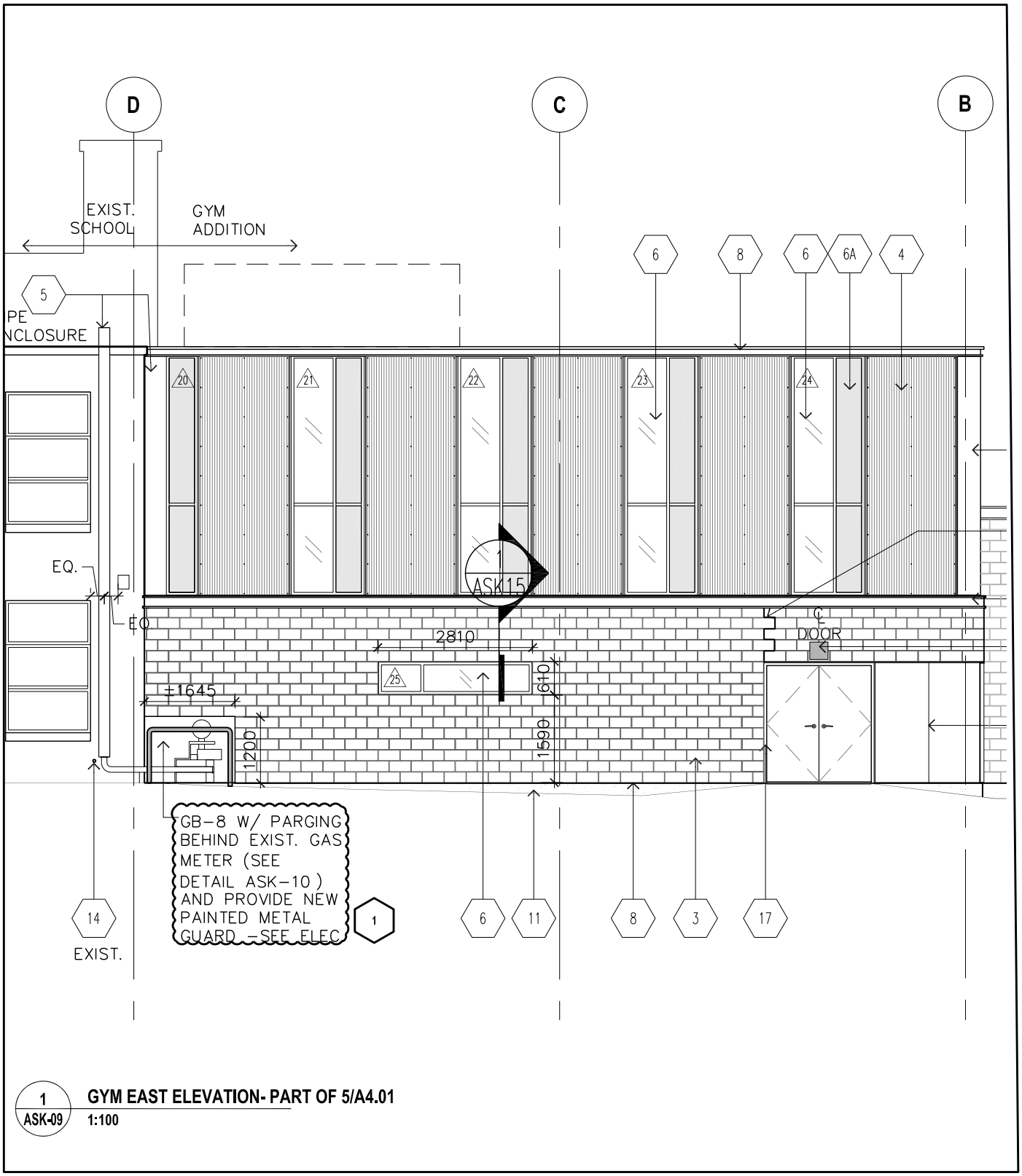
revision ·	Addendum no.1
revision date ·	29/SEPT/2011

drawing no. :

ASK.07



1 / ASK-09 **GYM EAST ELEVATION- PART OF 5/A4.01**

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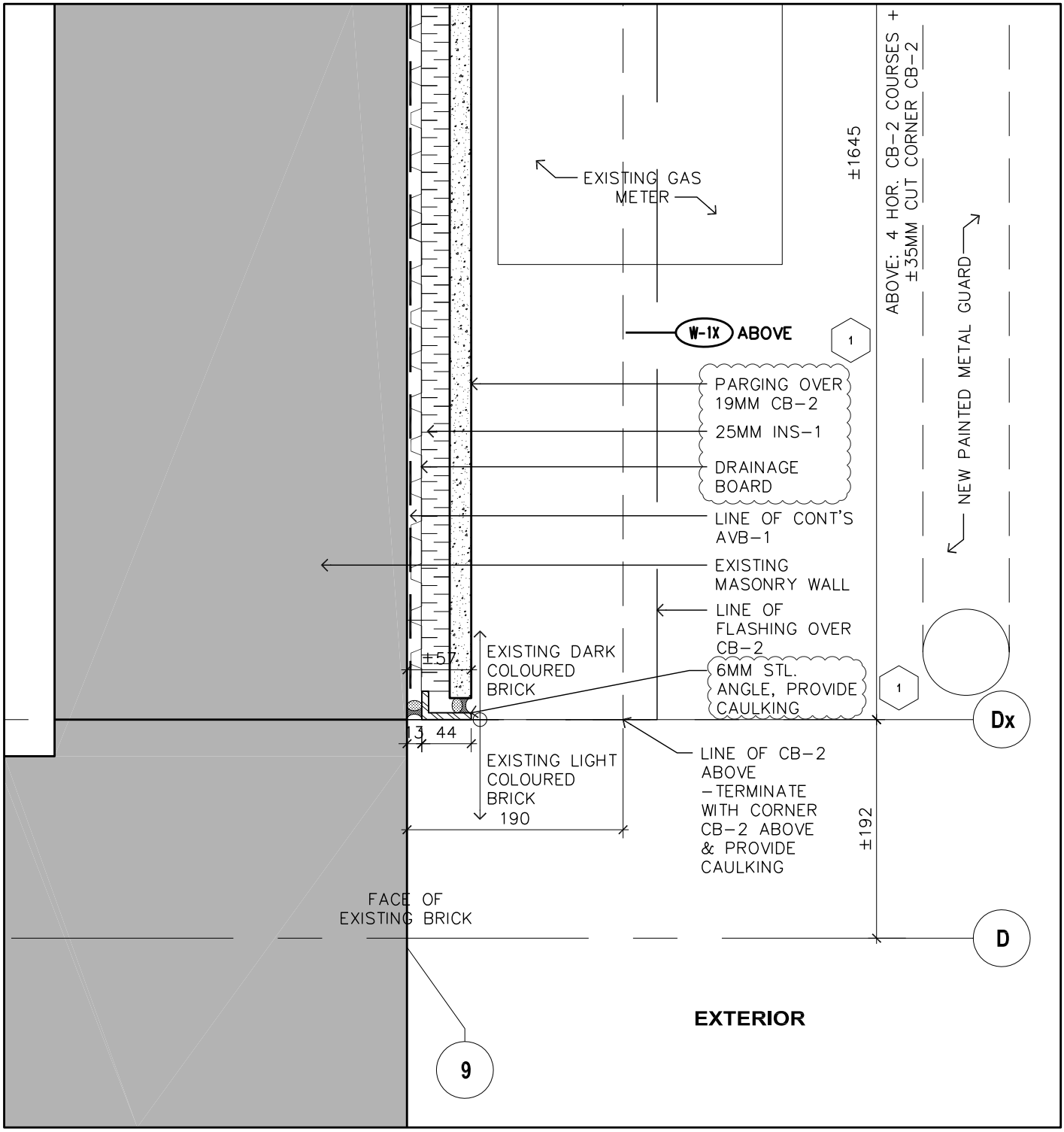
GYM - EAST SIDE EXTERIOR ELEVATION

project no. :	1108
scale :	1:100
date :	SEPTEMBER 2011
drawn by :	AG
issued for :	
revision :	Addendum no.1
revision date :	29/SEPT/2011

drawing no. : **ASK.09**



1 / ASK-10 **EXTERIOR BASE PLAN DETAIL - PART OF 4/A6.02**

1:5

CEDARVALE CS - CLASSROOM AND GYMNASIUM ADDITION

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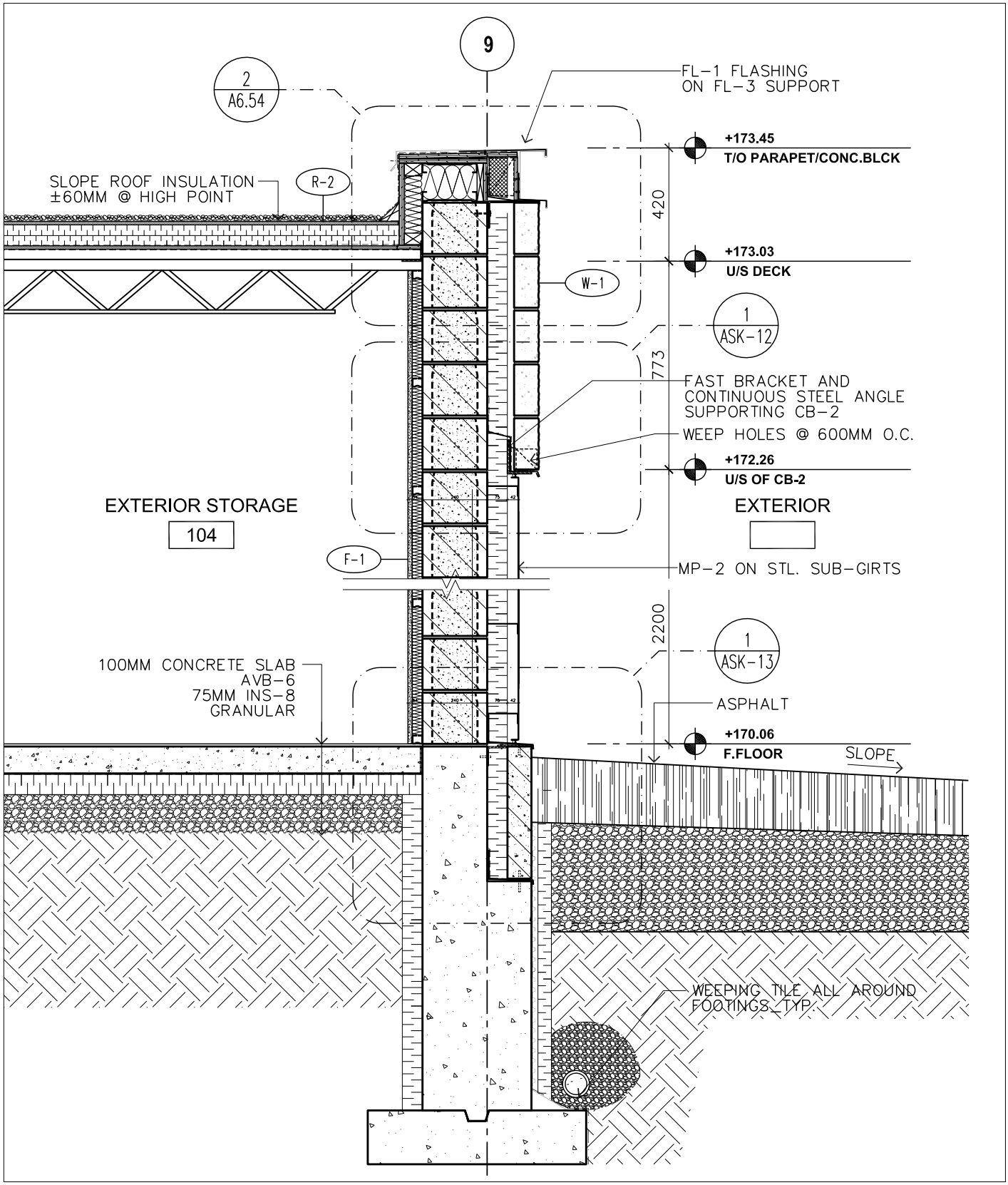
EXTERIOR BASE PLAN DETAIL

project no. :	1108
scale :	1:5
date :	SEPTEMBER 2011
drawn by :	AG
issued for ·	
revision ·	Addendum no.1
revision date ·	29/SEPT/2011

drawing no. : **ASK.010**



1 / ASK-011 **WALL SECTION- @ EXTERIOR STORAGE**

1:20

CEDARVALE CS - CLASSROOM AND GYMNASIUM ADDITION

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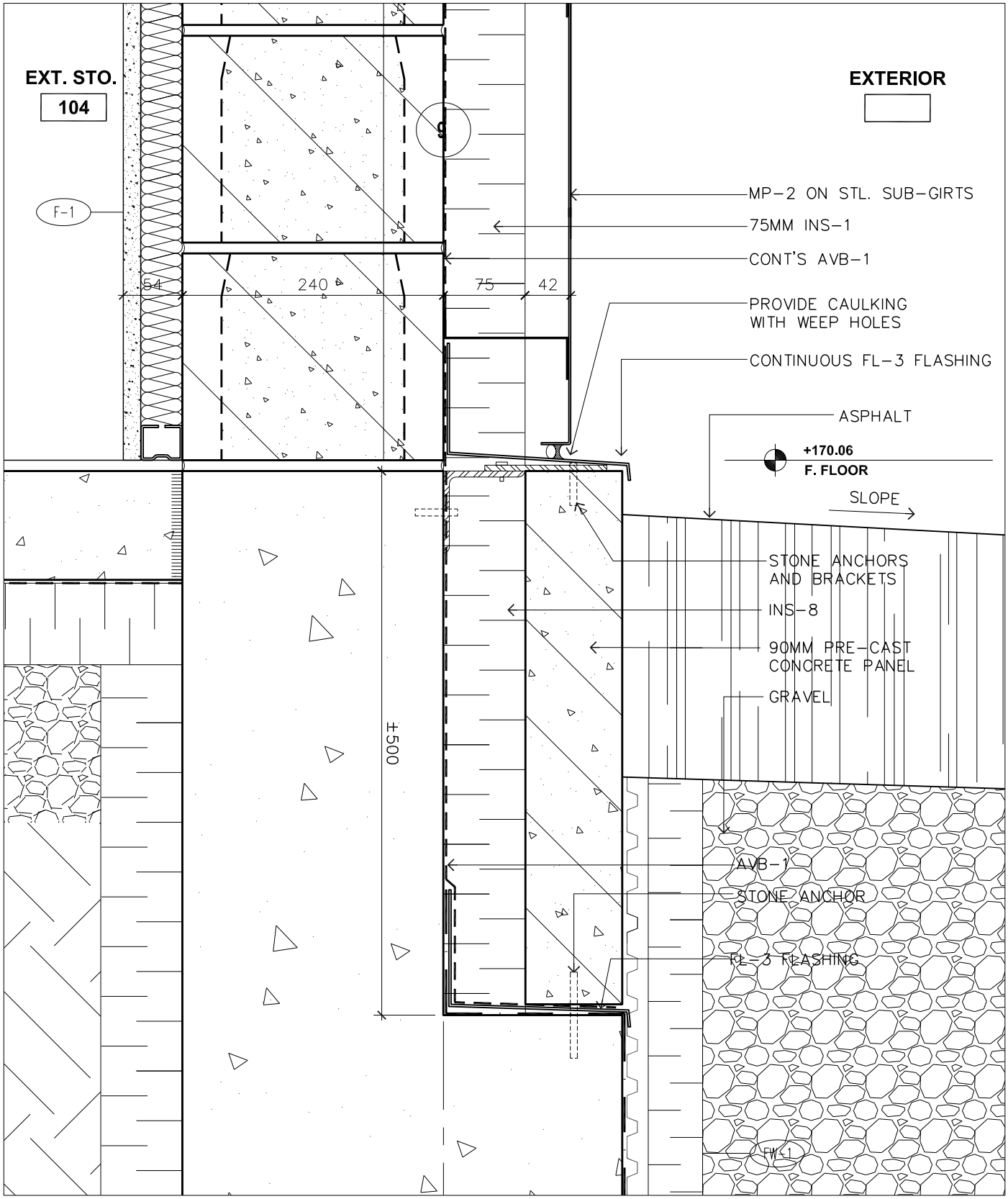
WALL SECTION @ EXTERIOR STORAGE

project no. :	1108
scale :	1:20
date :	SEPTEMBER 2011
drawn by :	AG
issued for :	
revision :	Addendum no.1
revision date :	26/SEPT/2011

drawing no. : **ASK.011**



1
ASK-013

SECTION DETAIL- PART OF 9/A6.53
1:5

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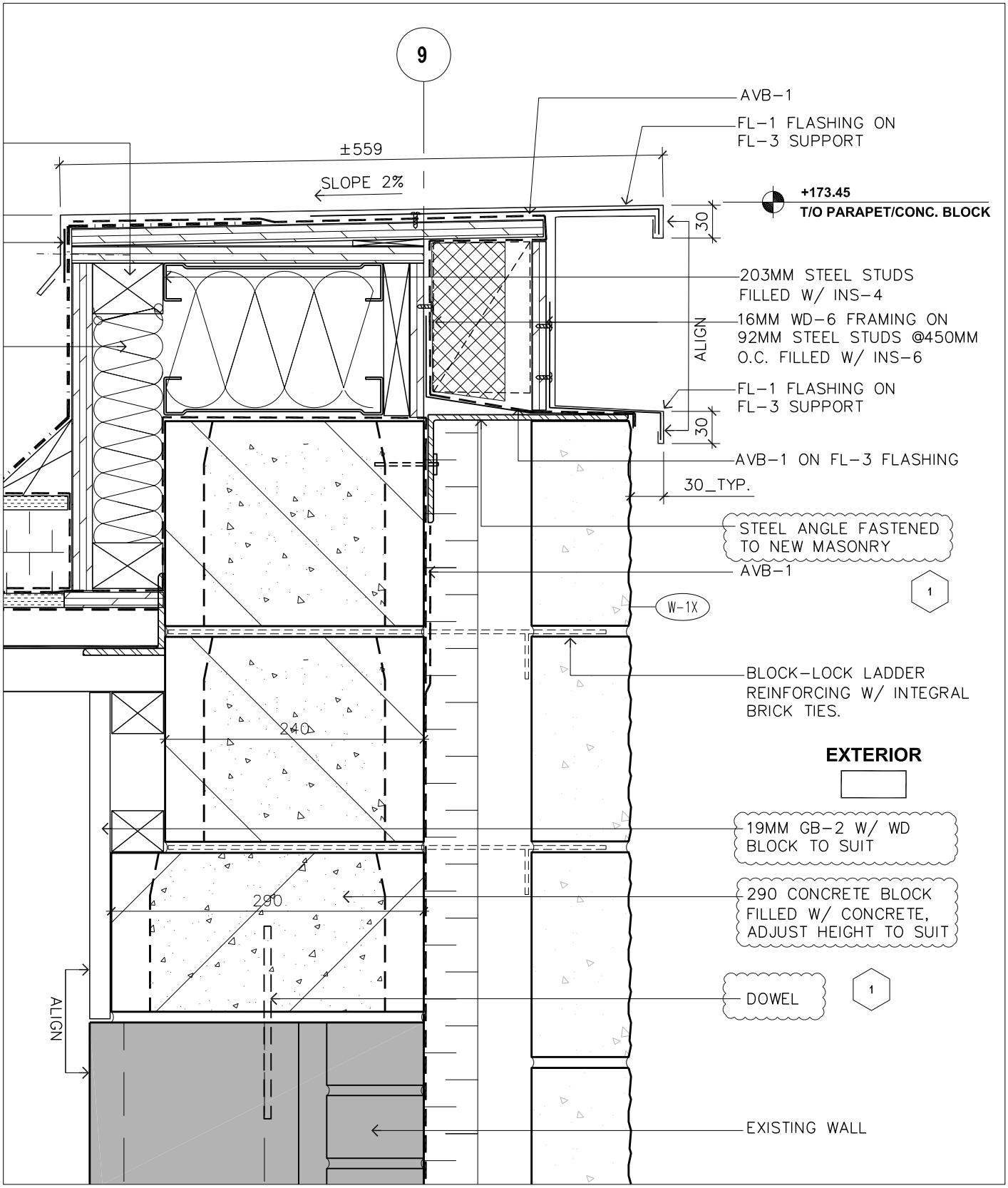
SECTION DETAIL @ EXTERIOR STORAGE

project no. :	1108
scale :	1:5
date :	SEPTEMBER 2011
drawn by :	AG
issued for :	
revision :	Addendum no.1
revision date :	26/SEPT/2011

drawing no. : **ASK.013**



1
ASK-014

SECTION DETAIL- PART OF 4/A6.54

1:5

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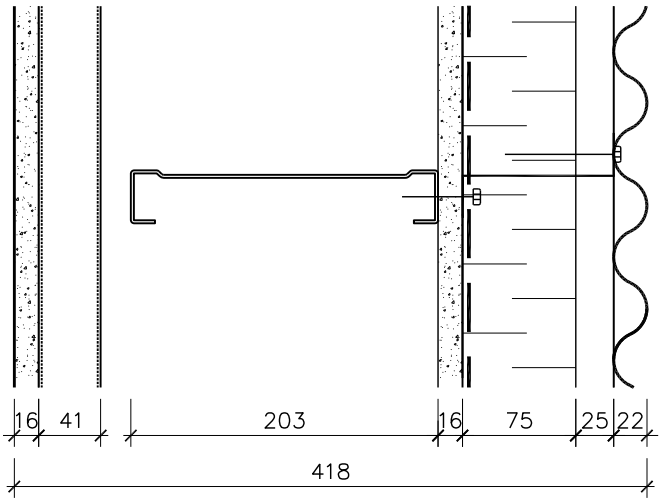
SECTION DETAIL @ BOY'S CHANGEROOM

project no. :	110
scale :	1:5
date :	SEPTEMBER 2011
drawn by :	AG
issued for :	
revision :	Addendum no.1
revision date :	26/SEPT/2011

drawing no. : **ASK.014**

W-2 WALL

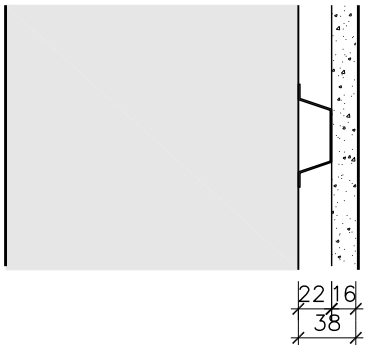
LOCATION: UPPER LEVEL WALLS @ GYM



22MM CORRUGATED METAL PANEL
GALV. HORIZONTAL STL. GIRTS
25MM AIR SPACE
75MM INS-1
AVB-1
16MM GB-4
203MM STRUC. STEEL STUDS
41MM STRUC. STEEL STUDS FURRING (SHIM TO SUIT)
16MM GB-1
FINISH

1

F-3 FURRING

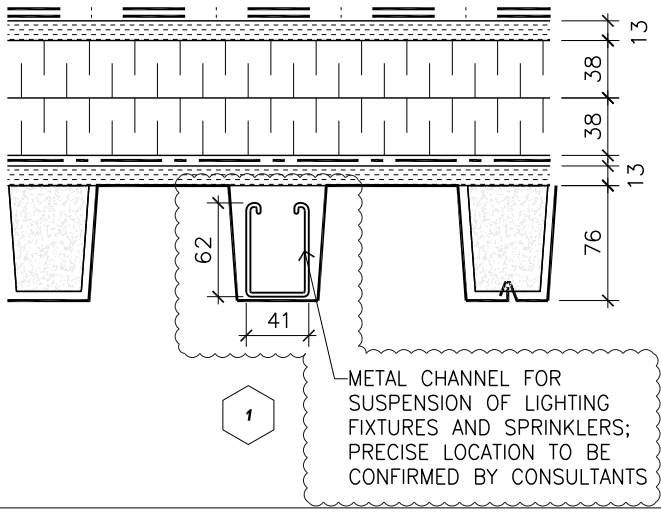


1

FINISH
16MM GB-1
22MM FURRING CHANNEL
EXISTING OR NEW MASONRY WALL

VARIATION: F-3A
FINISH
16MM GB-2
22MM 24 GA. FURRING CHANNEL
EXISTING OR NEW MASONRY WALL

R-1 ROOF



1

METAL CHANNEL FOR SUSPENSION OF LIGHTING FIXTURES AND SPRINKLERS; PRECISE LOCATION TO BE CONFIRMED BY CONSULTANTS

5-PLY BUILT-UP ROOF SYSTEM W/
2-PLY MOD BIT FLASHING
INS-5 AS PER ROOF PLANS
13MM MIN. INS - 5
2 LAYERS 38MM INS-3
AVB-3
13MM GB-5
76MM ACOUSTIC METAL DECK-SEE STRUCT. DWG. FOR DETAILS

NOTE:
1. PROVIDE TAPERED INSULATION NOTED ON ROOF PLAN
2. SEE RCP FOR LOCATION OF ACOUSTIC METAL DECK
3. CONTRACTOR TO CONFIRM FLUTE DIMENSIONS WITH METAL DECK SUPPLIERS AND METAL CHANNEL

1

1
ASK-016

TYPES- PART OF A0.02
1:5

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TYPES - WALL, FURRING, ROOF

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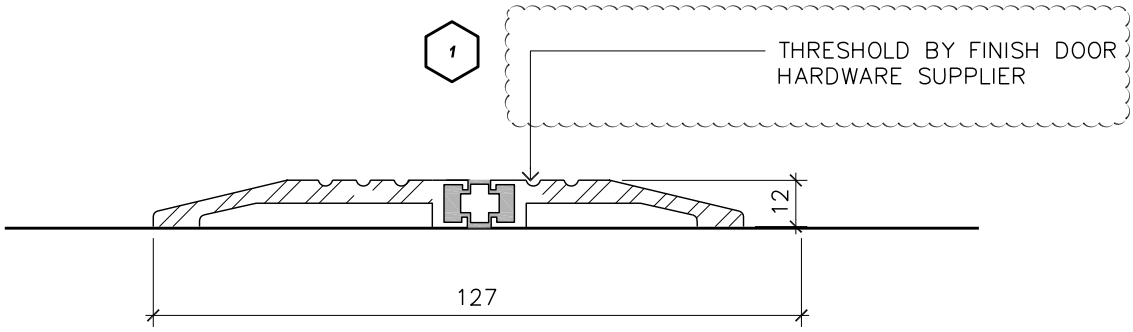
scale :	1:5
date :	SEPTEMBER 2011
drawn by :	AG
issued for :	
revision :	Addendum no.1
revision date :	29/SEPT/2011

drawing no. : **ASK.016**

THR-1 THRESHOLD TRIM



1 / ASK-017 **THR-1 THRESHOLD TRIM - PART OF A0.02**
1:5

MATERIAL ABBREVIATIONS

1

GB-2	HIGH ABUSE-RESISTANT GYPSUM BOARD
GB-8	CEMENT BOARD
GL-3	CLEAR FIRE-RATED GLASS MIN. 45 MIN. FIRE RESISTANCE RATING
GL-4	CLEAR FIRE-RATED GLASS MIN. 60 MIN. FIRE RESISTANCE RATING

SU-1	GL-1, AIRSPACE, GL-1 W/ LOW 'E' COATING
SU-2	GL-1, AIRSPACE, GL-1 W/ LOW 'E' COATING & SOLAR FILM
SU-3	GL-1, AIRSPACE, GL-1
SU-4	GL-1, AIRSPACE, GL-6

2 / ASK-017 **MATERIAL ABBREVIATIONS- PART OF A0.02**
N.T.S

ROOM FINISH SCHEDULE

1

ROOM NO.	LOCATION	FLOOR MAT'L	BASE TYPE	WALLS N	E	S	W	CEILING
102A	GIRLS CHANGE ROOM	EXIST.	B-1A	PT	PT	PT	PT	CL-3
106	STAGE AREA	VCT	B-1A	PT	PT	PT	PT	CL-1
118	CLASSROOM	EXIST.	B-1B	PT/GL	PT/GL	PT	PT	CL-3

3 / ASK-017 **ROOM FINISH SCHEDULE- PART OF A0.02**
N.T.S

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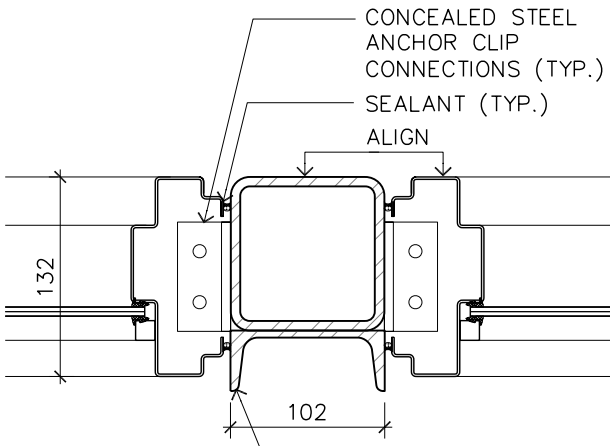
THR-1, MATERIAL ABB., ROOM FINISH SCHEDULE

project no. : 1108
scale :
date : SEPTEMBER 2011
drawn by : AG
issued for :
revision : Addendum no.1
revision date : 29/SEPT/2011

drawing no. : **ASK.017**

HMF-1M

HM WINDOW JAMBS AT COLUMN



CORRIDOR

1 / ASK-018 **HMF-1M - PART OF A0.03**

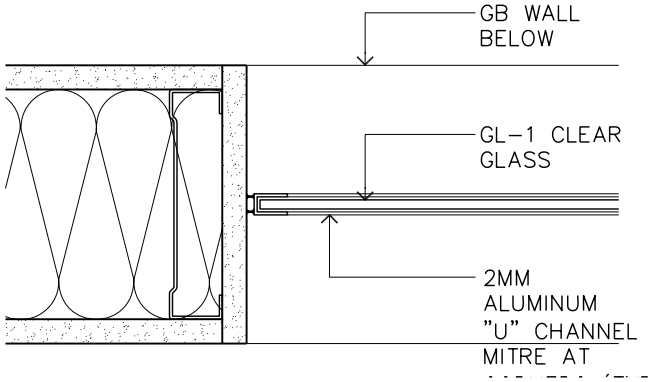
1:5

ALUMINUM SHOE PROFILES

TEACHER'S ROOM

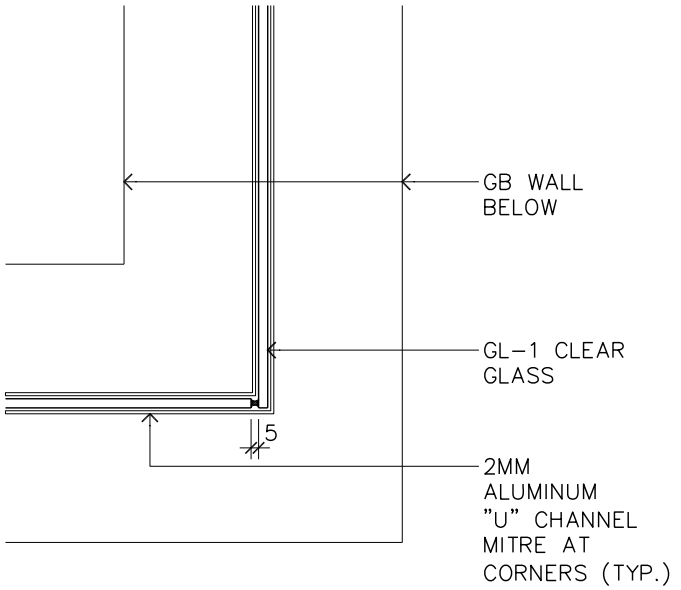
HMF-4A

WINDOW JAMB (TYP.)



HMF-4B

GLASS TO GLASS CORRENER



2 / ASK-018 **ALUM. SHOE PROFILES - PART OF A0.03**

1:5

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ALUMINUM SHOE PROFILES, HMF-1M

project no. :	1108
scale :	1:5
date :	SEPTEMBER 2011
drawn by :	AG
issued for :	
revision :	Addendum no.1
revision date :	29/SEPT/2011

drawing no. : ASK.018

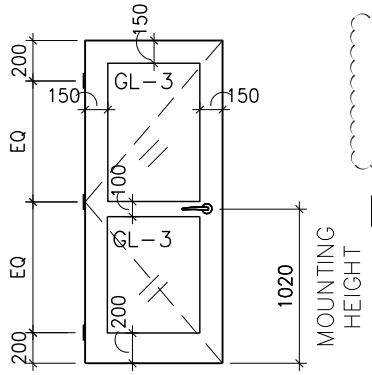
DOOR SCHEDULE

DOOR NO.	ROOM NO.	DOOR WIDTH	HEIGHT	THICK	DOOR MAT'L	FINISH	TYPE	FRAME MAT'L	FIRE RTG.	REMARKS
D101-2	101/GYMNASIUM	±914	±2135	45	WD	PREFINISHED	D-4	HM	45	V.I.F. - NEW DR ON EXIST. FRAME
D110	110/CORRIDOR	2x910	2150	45	HM	PAINTED	D-5	HM	20	
D111-1	111/VESTIBULE	2x910	2150	52	AL	CLEAR ANOD.	D-8	AL	1	
D111-2	111/VESTIBULE	2x910	2150	52	AL	CLEAR ANOD.	D-8	AL		

1 / ASK-019 **DOOR SCHEDULE - PART OF A0.03**

N.T.S.

D-4 DOOR INT.



WD DOOR W/GL-3
GLAZING - 45 MIN.
F.P.R.

1

2 / ASK-019 **D-4 DOOR - PART OF A0.03**

1:50

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DOOR SCHEDULE, D-4 DOOR

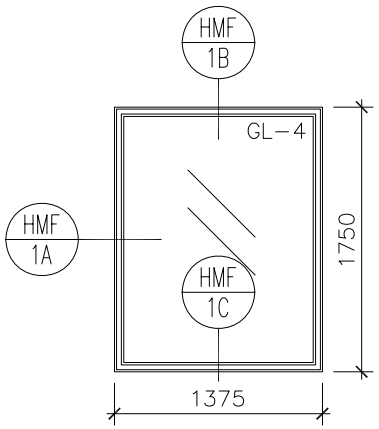
project no. :	1108
scale :	AS NOTED
date :	SEPTEMBER 2011
drawn by :	AG
issued for :	
revision :	Addendum no.1
revision date :	29/SEPT/2011

drawing no. : ASK.019

INTERIOR GLAZING SCHEDULE

F1 - GYMNASIUM

60 MIN. F.R.R.



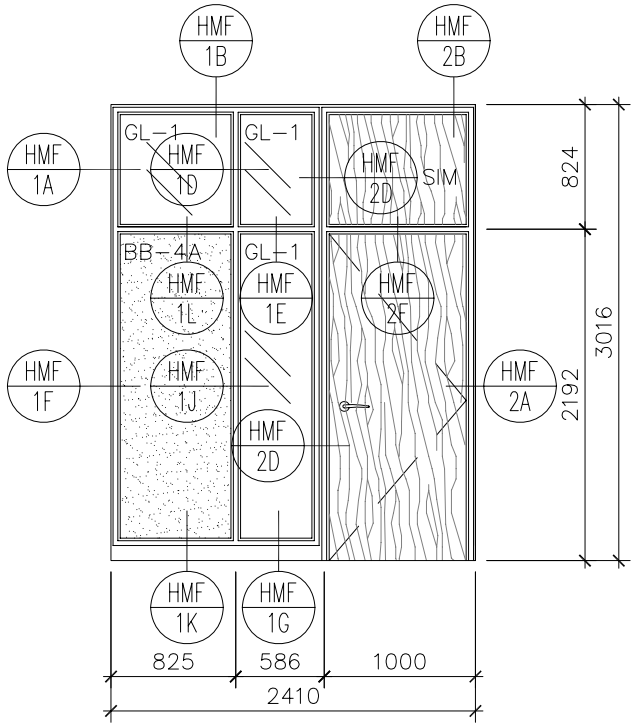
NOTE:
DIMENSIONS ARE TAKEN FROM EDGE OF FRAME TO CENTRE LINE OF INTERMEDIATE MULLION UNLESS NOTED OTHERWISE. (TYP.)

ALL DIMENSIONS TO BE SITE VERIFIED.

F2 - CLASSROOM 114

VIEW FROM CLASSROOM SIDE

NON FIRE-RATED



1 / ASK-20 **INTERIOR GLAZING SCHEDULE- PART OF A0.03**
1:50

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INTERIOR GLAZING SCHEDULE

project no. :	1108
scale :	1:50
date :	SEPTEMBER 2011
drawn by :	AG
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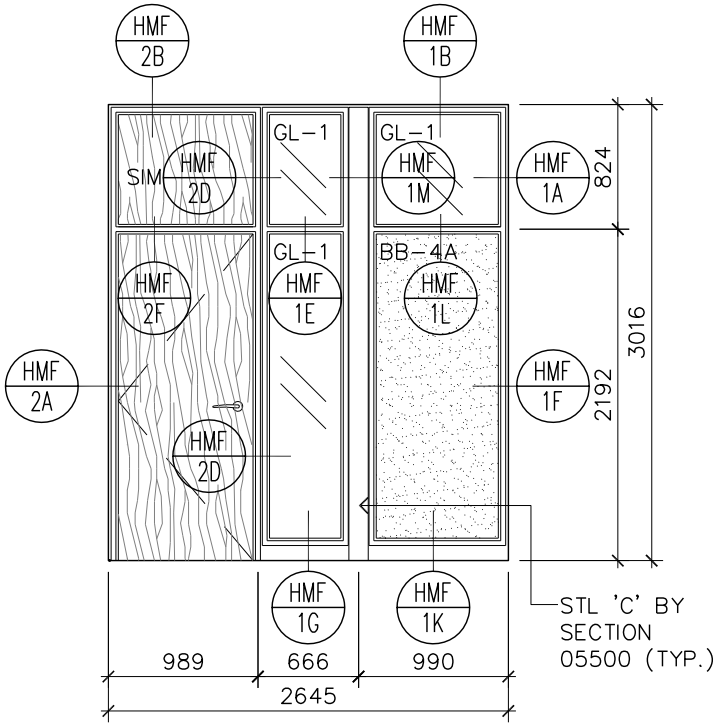
revision :	Addendum no.1
revision date :	29/SEPT/2011
drawing no. :	ASK.20

INTERIOR GLAZING SCHEDULE

F3 - CLASSROOM 115

VIEW FROM CLASSROOM SIDE

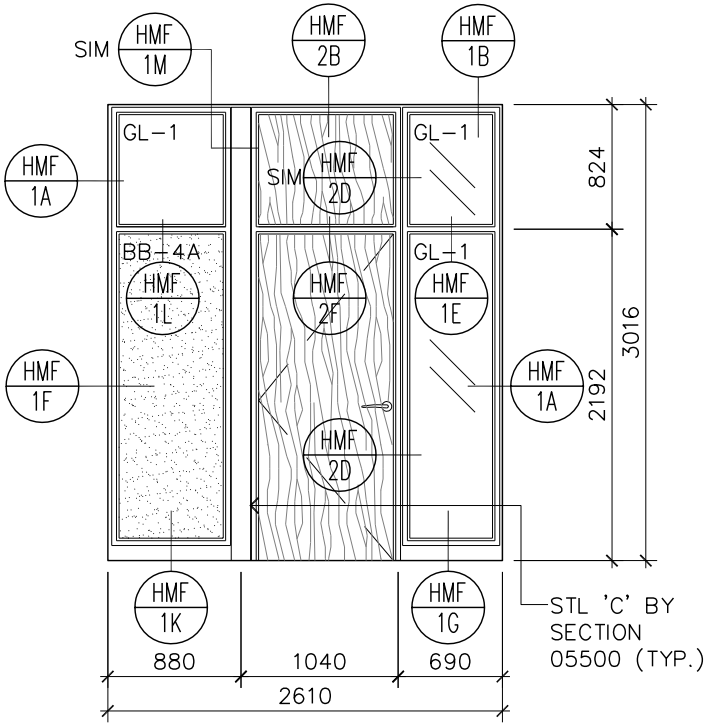
NON FIRE-RATED



F4 - CLASSROOM 116

VIEW FROM CLASSROOM SIDE

NON FIRE-RATED



1 / ASK-21 **INTERIOR GLAZING SCHEDULE- PART OF A0.03**

1:50

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INTERIOR GLAZING SCHEDULE

project no. :	1108
scale :	1:50
date :	SEPTEMBER 2011
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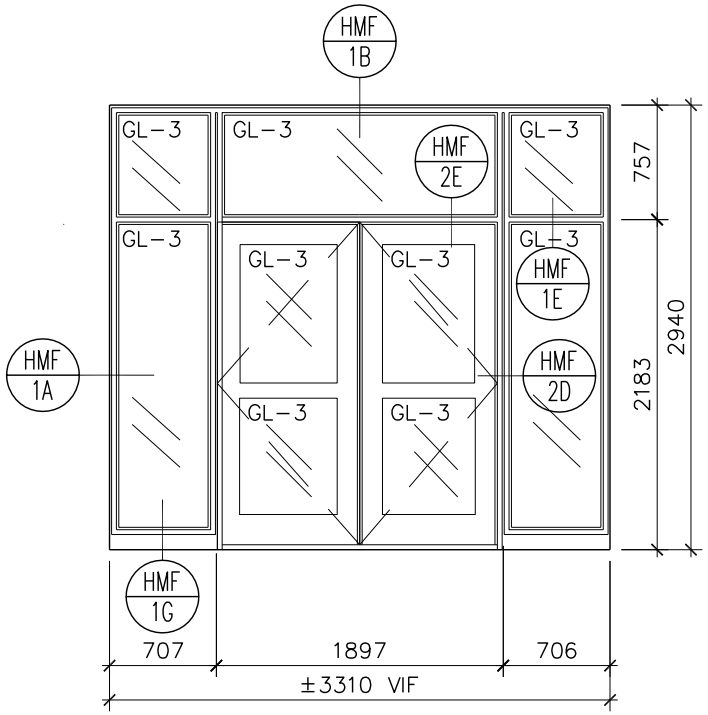
revision :	Addendum no.1
revision date :	29/SEPT/2011
drawing no. :	ASK.21

INTERIOR GLAZING SCHEDULE

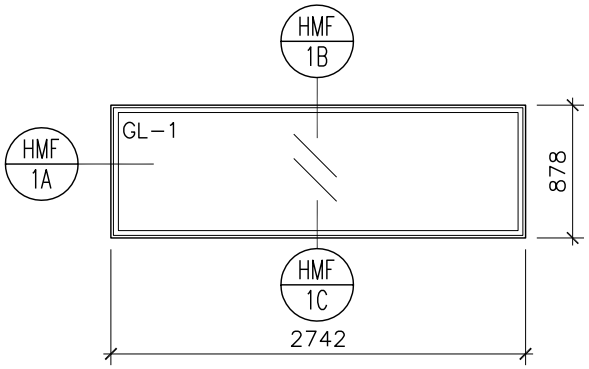
F5 - CORRIDOR

45 MIN. F.R.R.



F6 - CLASSROOM 109

VIEW FROM CLASSROOM SIDE



1 / ASK-22 **INTERIOR GLAZING SCHEDULE- PART OF A0.03**

1:50

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INTERIOR GLAZING SCHEDULE

project no. :	1108
scale :	1:50
date :	SEPTEMBER 2011
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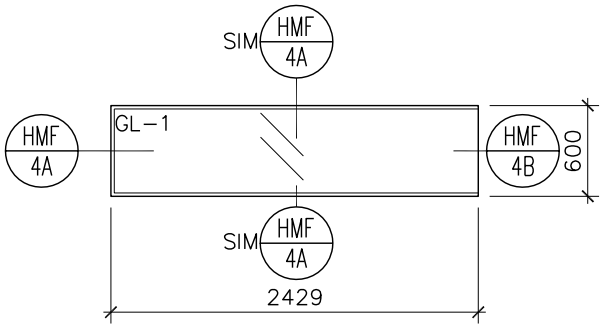
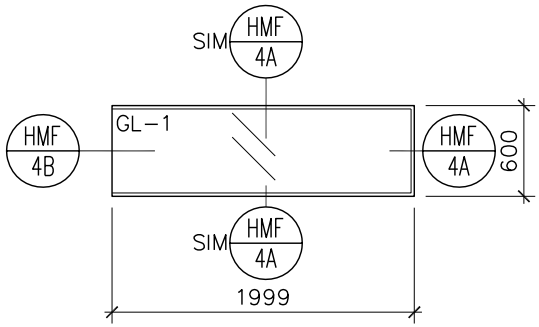
issued for :	
revision :	Addendum no.1
revision date :	29/SEPT/2011
drawing no. :	ASK.22

INTERIOR GLAZING SCHEDULE

F7 - TEACHER'S ROOM



F8 - TEACHER'S ROOM



1 / ASK-23 **INTERIOR GLAZING SCHEDULE- PART OF A0.03**
1:50

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INTERIOR GLAZING SCHEDULE

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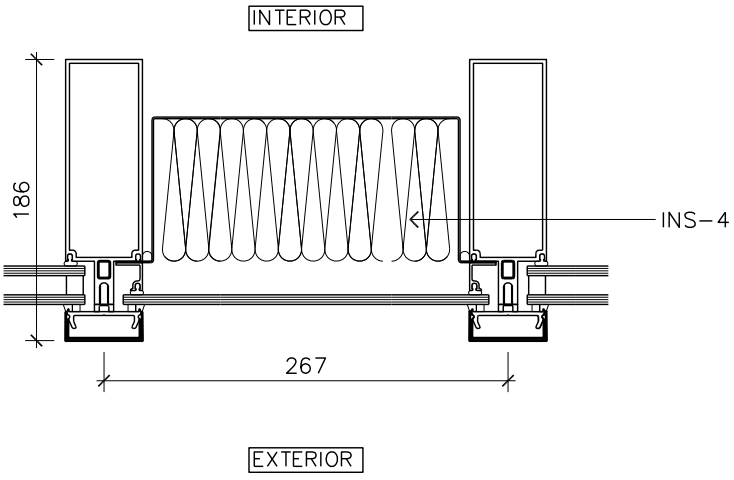
revision :	Addendum no.1
revision date :	29/SEPT/2011
drawing no. :	ASK.23

ALUMINUM FRAME PROFILES - CURTAIN WALL SYSTEM

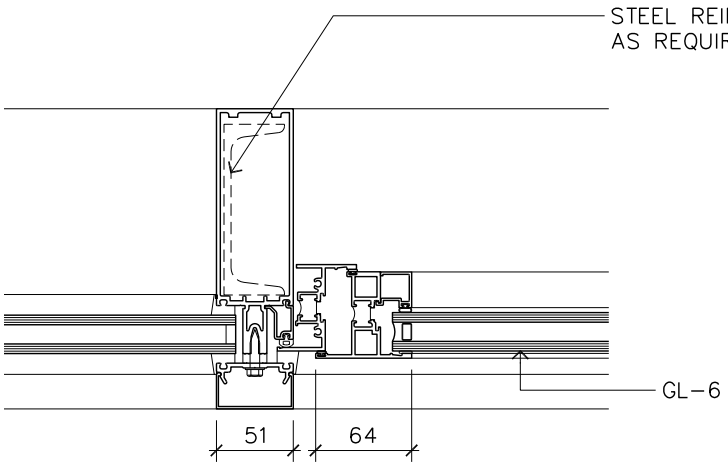
ALF-1Q

CURTAIN WALL SPANDREL



ALF-1R

T/H OPERABLE WINDOW MULLION



1
ASK-024

ALUMINUM FRAME PROFILES - PART OF A0.04

1:5

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ALUMINUM FRAME PROFILES

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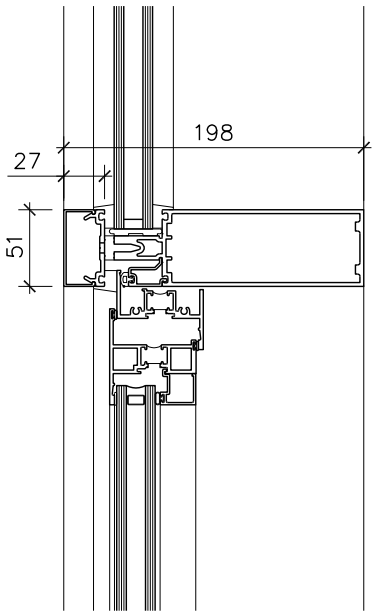
revision ·	Addendum no.1
revision date ·	29/SEPT/2011

drawing no. : ASK.024

ALUMINUM FRAME PROFILES - CURTAIN WALL SYSTEM

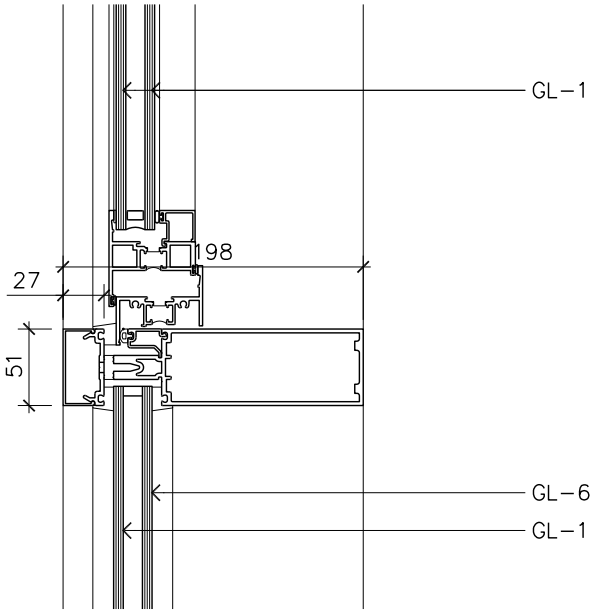
ALF-1S

T/H OPERABLE WINDOW HEAD



ALF-1T

T/H OPERABLE WINDOW SILL



1
ASK-025

ALUMINUM FRAME PROFILES - PART OF A0.04

1:5

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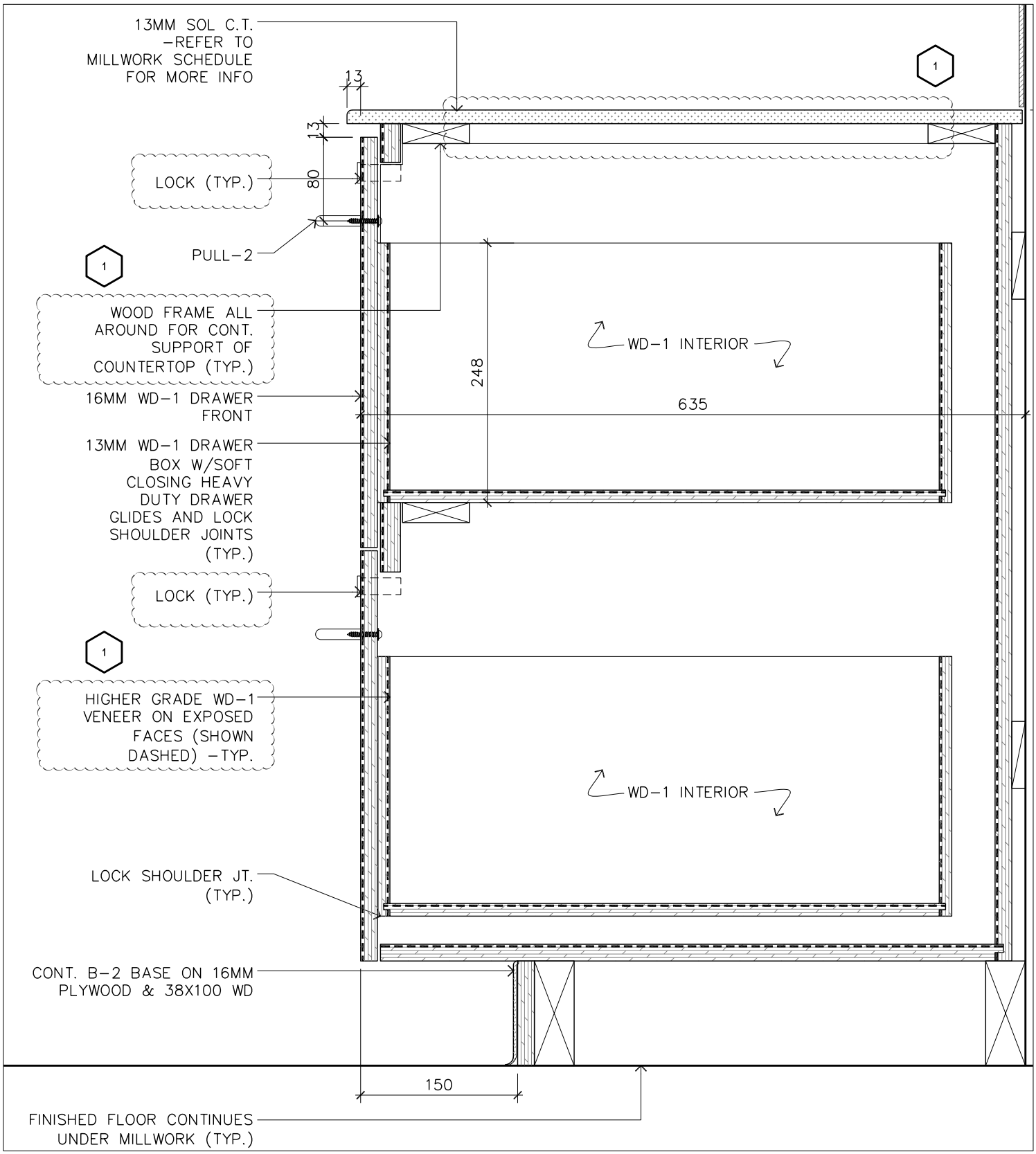
ALUMINUM FRAME PROFILES

project no. :	1108
scale :	1:5
date :	SEPTEMBER 2011
drawn by :	AG
issued for ·	
revision ·	Addendum no.1
revision date ·	29/SEPT/2011

drawing no. : ASK.025



1
ASK-026

MILLWORK DETAILS - PART OF 4/A9.02

1:5

CEDARVALE CS - CLASSROOM AND GYMNASIUM ADDITION

145 AVA RD. YORK, ONTARIO

Taylor Smyth architects

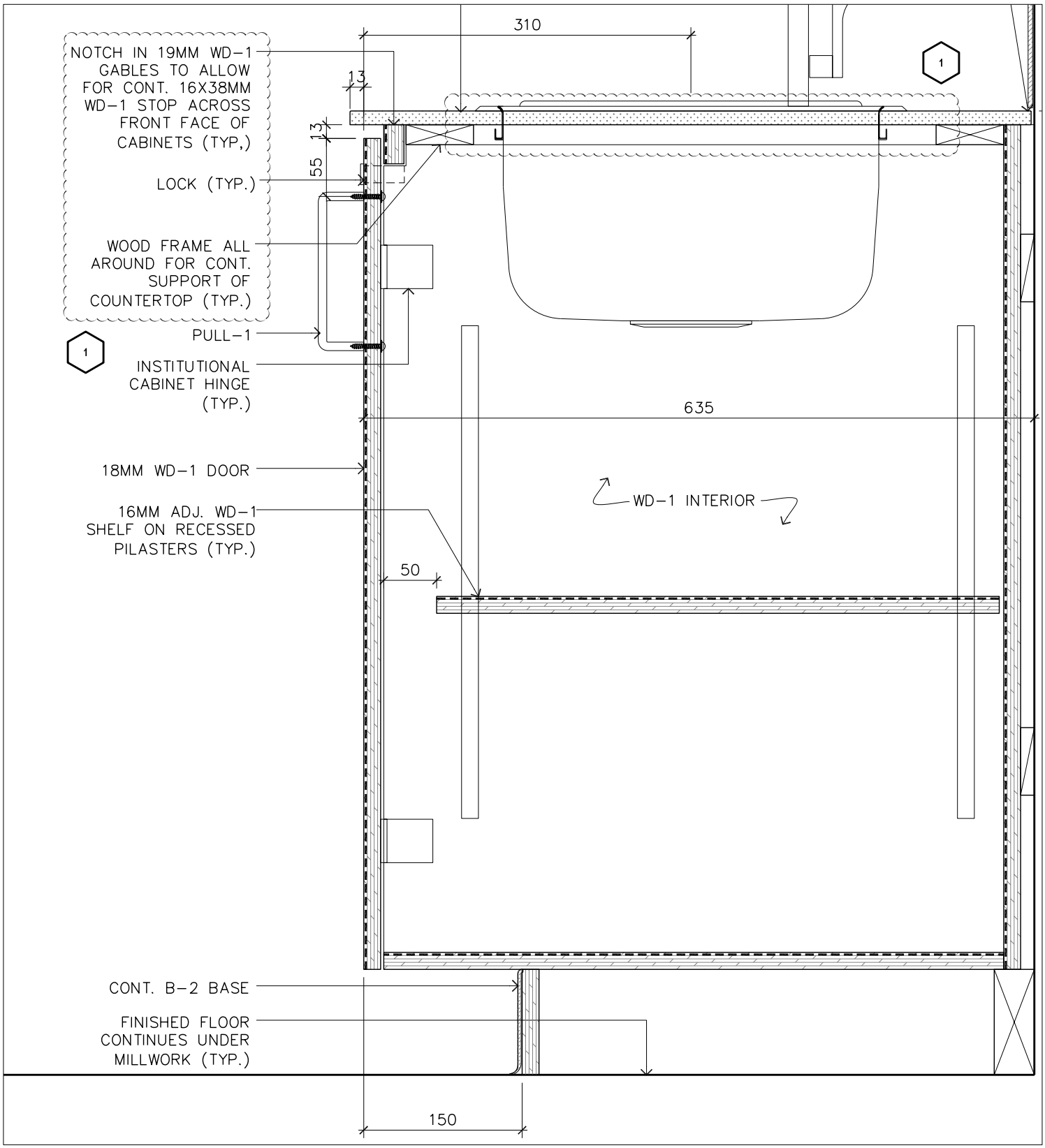
245 Davenport Road
Suite 300, Toronto
Ontario M5R 1K1
t. 416.968.6688
f. 416.968.7728

ONTARIO ASSOCIATION OF ARCHITECTS
ROBERT SMYTH
LICENCE
4677

MILLWORK DETAILS

project no. :	1108
scale :	1:5
date :	SEPTEMBER 2011
drawn by :	AG
issued for :	
revision :	Addendum no.1
revision date :	29/SEPT/2011

drawing no. : ASK.026



1
ASK-027

MILLWORK DETAILS - PART OF 3/A9.02

1:5

CEDARVALE CS - CLASSROOM AND GYMNASIUM ADDITION

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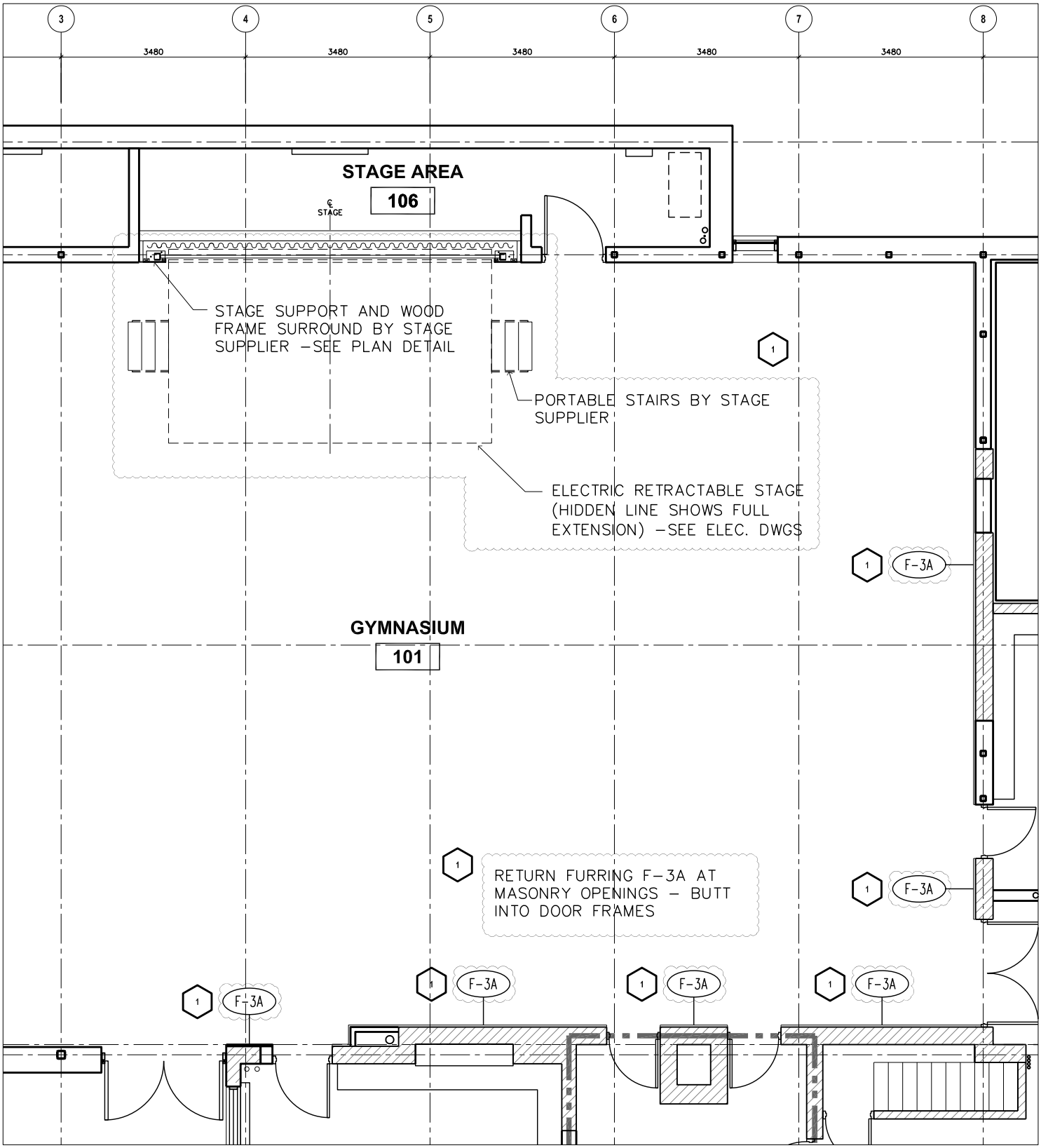
MILLWORK DETAILS

project no. :	1108
scale :	1:5
date :	SEPTEMBER 2011
drawn by :	AG
issued for / revision :	Addendum no.1
revision date :	29/SEPT/2011

drawing no. : **ASK.027**



1
ASK-028

GROUND FLOOR PLAN-GYM EXPANSION - PART OF 2/A2.01

1:100

CEDARVALE CS - CLASSROOM AND GYMNASIUM ADDITION

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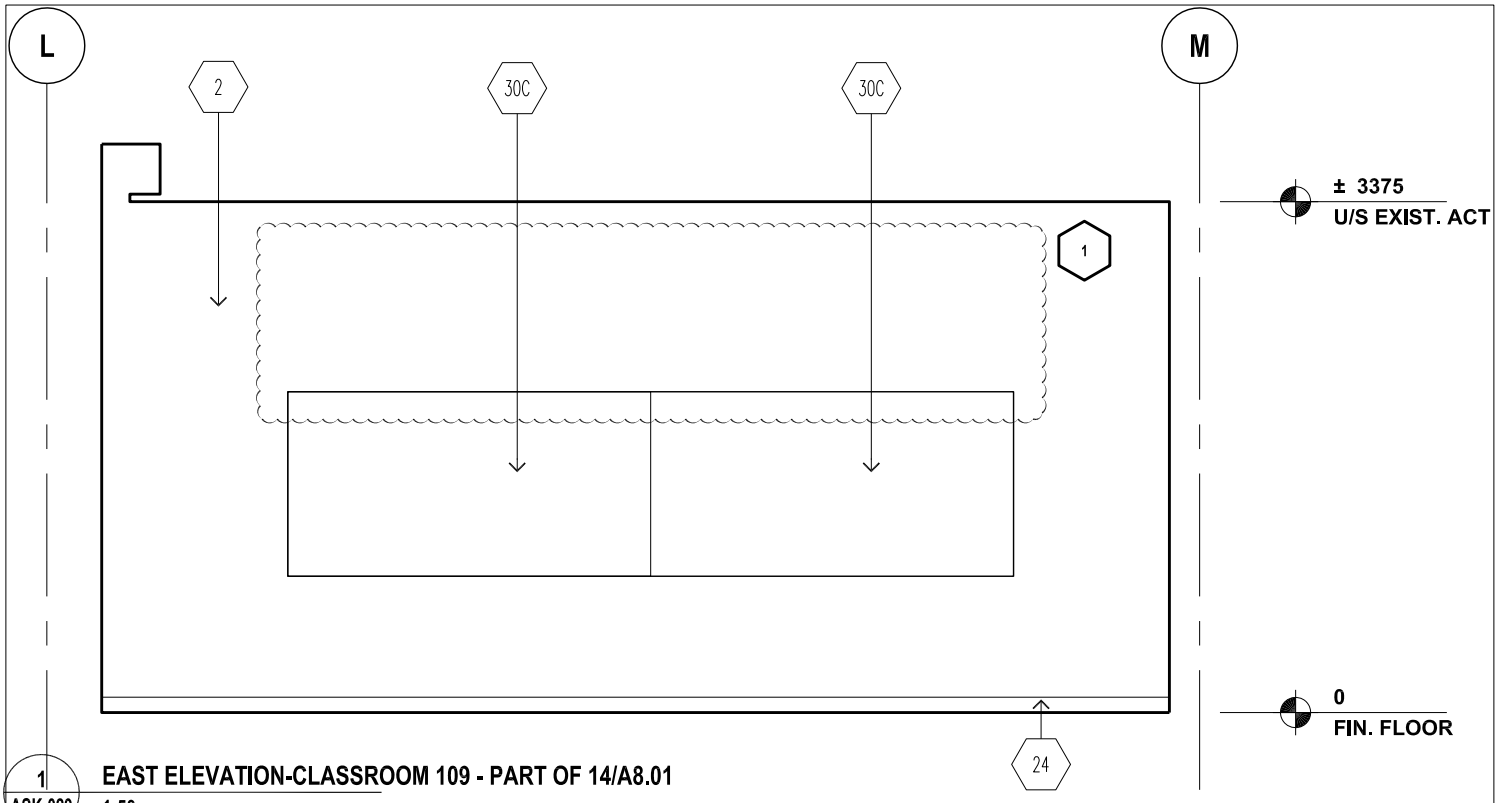
GROUND FLOOR PLAN

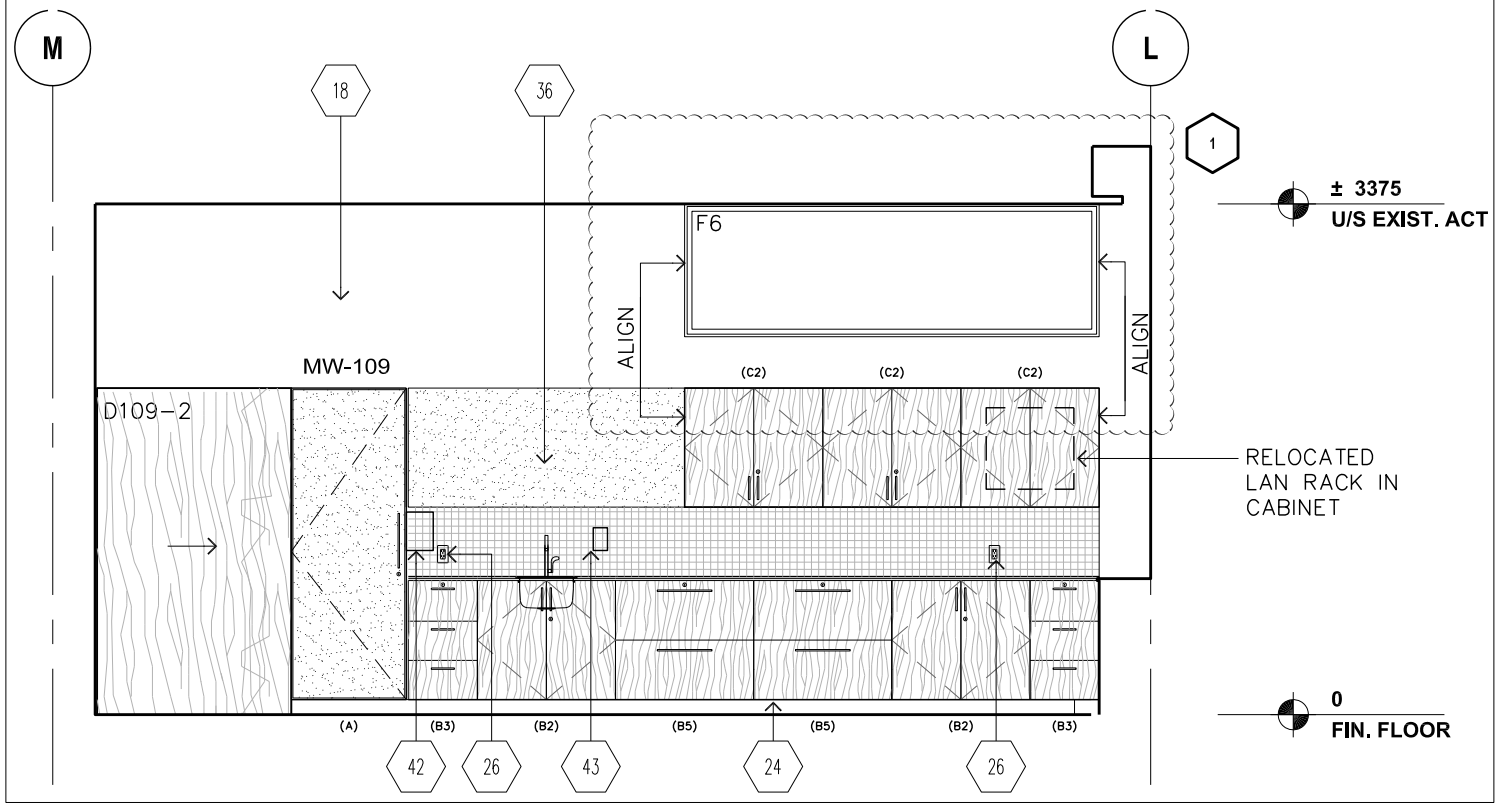
project no. :	1108
scale :	1:100
date :	SEPTEMBER 2011
drawn by :	AG
issued for ·	
revision ·	Addendum no.1
revision date ·	29/SEPT/2011

drawing no. : ASK.028



1 ASK-029 **EAST ELEVATION-CLASSROOM 109 - PART OF 14/A8.01**

1:50



2 ASK-029 **WEST ELEVATION-CLASSROOM 109 - PART OF 16/A8.01**

1:50

CEDARVALE CS - CLASSROOM AND GYMNASIUM ADDITION

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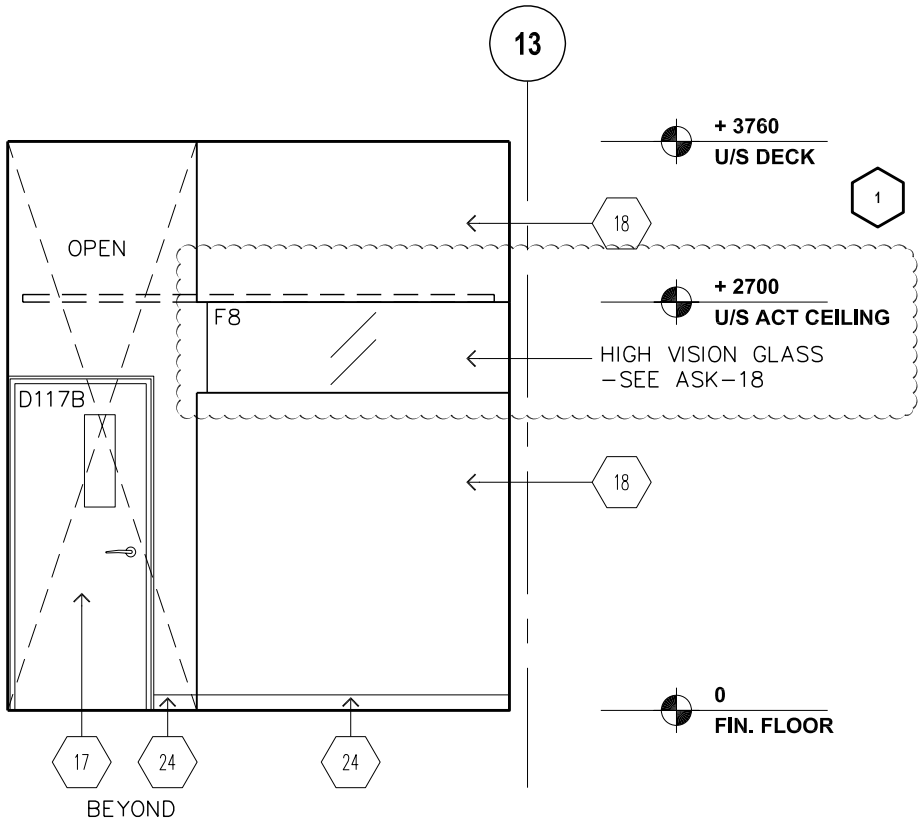
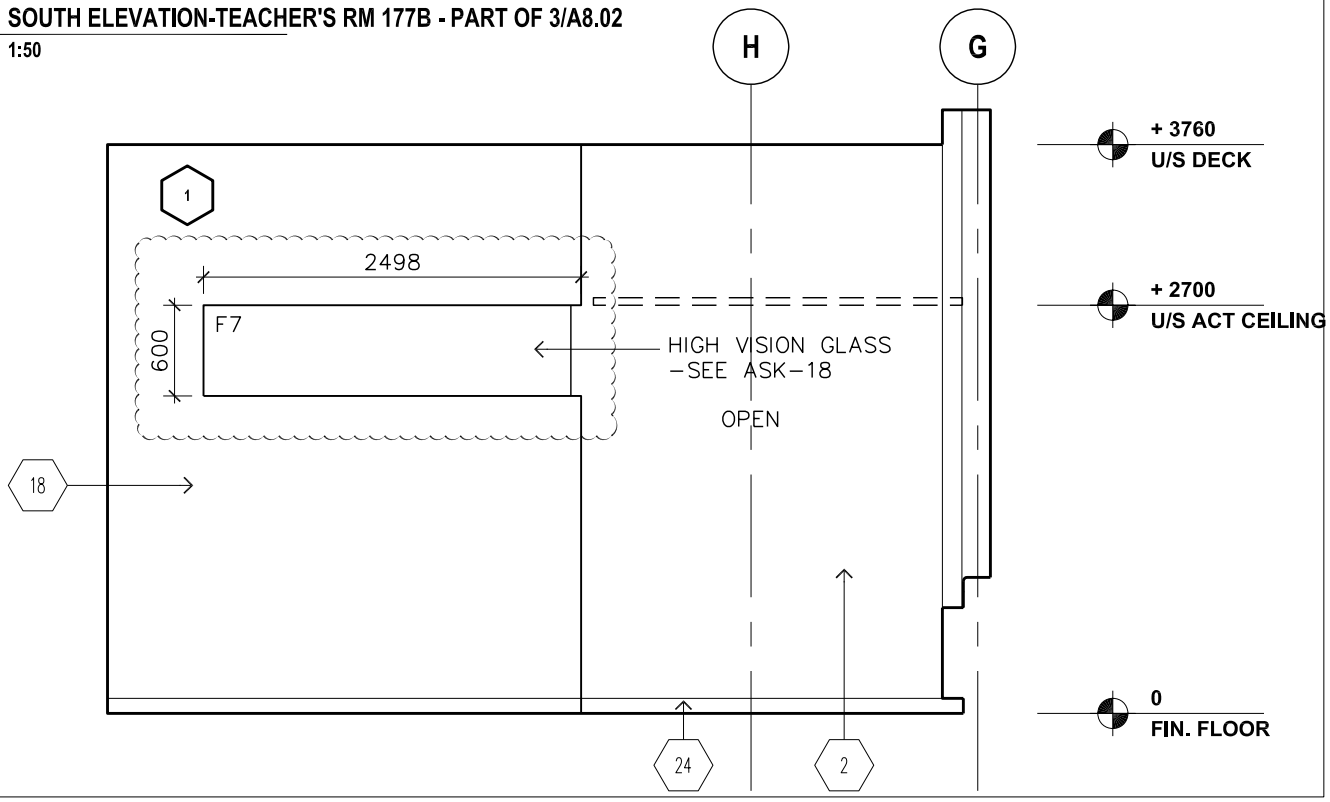
CLASSROOM 109 INTERIOR ELEVATIONS

project no. :	1108
scale :	1:50
date :	SEPTEMBER 2011
drawn by :	AG
issued for ·	
revision ·	Addendum no.1
revision date ·	29/SEPT/2011

drawing no. : ASK.029



1 ASK-030 **SOUTH ELEVATION-TEACHER'S RM 177B - PART OF 3/A8.02**
1:50



2 ASK-030 **WEST ELEVATION-TEACHER'S RM 177B - PART OF 4/A8.02**
1:50

CEDARVALE CS - CLASSROOM AND GYMNASIUM ADDITION

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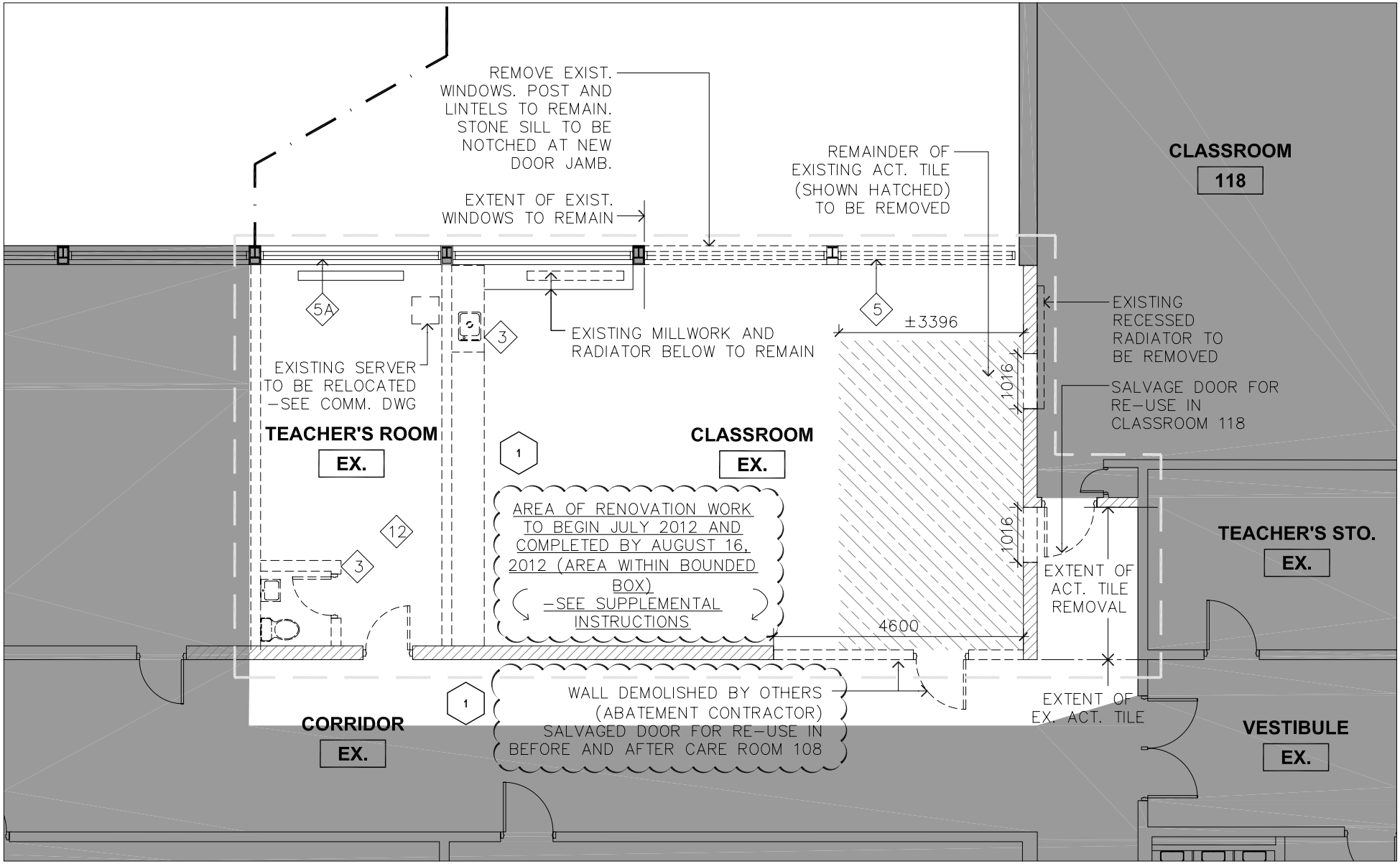
TEACHER'S ROOM 117B INTERIOR ELEVATIONS

project no. :	1108
scale :	1:50
date :	SEPTEMBER 2011
drawn by :	AG
issued for ·	
revision ·	Addendum no.1
revision date ·	29/SEPT/2011

drawing no. : **ASK.030**



1
ASK-31

PARTIAL DEMOLITION PLAN AT CLASSROOM - PART OF 5/A1.01b

1:100

CEDARVALE CS - CLASSROOM AND GYMNASIUM ADDITION

145 AVA RD. YORK, ONTARIO

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ONTARIO ASSOCIATION OF ARCHITECTS
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4677

PARTIAL DEMOLITION PLAN AT CLASSROOM

project no. :	1108
scale :	1:100
date :	SEPTEMBER 2011
drawn by :	AG
issued for :	
revision :	Addendum no.1
revision date :	29/SEPT/2011

drawing no. : **ASK.031**

coffey geotechnics
SPECIALISTS MANAGING THE EARTH

September 01, 2011

Toronto District School Board
15 Oakburn Crescent
Toronto, Ontario
M2N 2T5

E-Mail: maureen.mcauley@tdsb.on.ca

Attention: Ms. Maureen McAuley

Dear Sir;

RE: Chemical Testing Results
Proposed Building Addition, Cedarvale Community School
145 Ava Road, Toronto, Ontario

Seven (7) geotechnical boreholes were drilled by Coffey Geotechnics Inc. from June 25, 2011 to June 27, 2011 across the subject site and a geotechnical investigation report (GEOTETOB11546AA-AA, dated July 8, 2011) was submitted to Toronto District School Board c/o Taylor Smyth Architects. This letter presents the chemical testing results of selected Soil samples obtained in the geotechnical investigation. The location of the boreholes is indicated on drawing 1A of the Geotechnical Report (GEOTETOB11546AA-AA, dated July 8, 2011). It is a supplement to the geotechnical report mentioned above.

Two (2) soil samples were collected and submitted for bulk chemical analysis for general chemistry and inorganic parameters listed in the MOE document "Soil, Ground Water and Sediment Standards for Use under Part XV.1 of the Environmental Protection Act", dated April 15th, 2011 (MOE 2011 Standards) as stipulated in O.Reg 153/04, as amended.

The approximate depths of the samples taken from the boreholes from the fill and native layer are as follows:

Borehole No.	Sample No. Depth Below Surface(m)	Material
BH1	(SS2) 1.1 m	Native: Sandy Silt to Silty Sand
BH5	(SS1) 0.4 m	Fill: Silt to Clayey Silt

Chemical analyses were conducted by AGAT Laboratories Ltd. of Mississauga, Ontario. AGAT is a member of the Canadian Association for Environmental Analytical Laboratories and meets the requirements of Section 47 of O.Reg. 153/04 certifying that the analytical laboratory be accredited in accordance with the International Standard ISO/IEC 17025 and with standards developed by the Standards Council of Canada. The Certificates of Analysis are included in Appendix A and discussed below.

The results of the soil samples submitted for chemical analysis were compared to the full depth generic site condition Standards for MOE Table 1 All Other Types of Property Uses (i.e. non-agricultural property uses), Residential/Parkland/Institutional (RPI), and Industrial/Commercial/Community (ICC), property use with fine/coarse textured soils in a potable groundwater condition as contained in Table 2 and Table 3 of the MOE Standards.

Testing Results

The concentrations of all parameters analyzed in two submitted samples met the MOE Table1(All), Table 2 and Table 3 Standards for Residential/Parkland/Institutional (RPI) or Industrial/Commercial/Community (ICC) property uses.

Off-site Disposal Options

As the results meet the applicable Standard for the site, this material is considered suitable for re-use on site or for disposal at RPI and ICC sites permitted to accept clean fill. It should be noted that acceptance of this material will be at the discretion of the receiving site(s). The re-use of on-site materials are still subject to geotechnical consideration.

If disposed of at a licensed landfill, additional chemical testing may be required to classify the material for waste disposal purposes in accordance with Ontario Regulation 347 (as amended by O.Reg.558/00. It should be noted that acceptance of this material will be at the discretion of the receiving site(s).

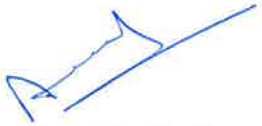
During excavations, if any soil is encountered that has unusual stained or odour (e.g. hydrocarbon or solvent odours), or contains rubble, debris, cinders or other visual evidence of impact, this soil should be segregated and Coffey should be contacted immediately. Such soil should not be removed from the subject site until the results of an assessment are available.

This testing has been conducted in order to assess the possible options for soil disposal only and is not intended to constitute a Phase 2 Environmental Site Assessment and as such, does not comment on the environmental condition of the site. Soil and/or groundwater quality may vary at locations other than those tested. Furthermore, the testing conducted as part of this program will not substantiate the preparation of a

Record of Site Condition in accordance with the Ontario Ministry of the Environment (MOE) Standards. Should a Record of Site Condition be required, a Phase 1 Environmental Site Assessment must be conducted, at a minimum, with the possible need for additional subsurface investigations.

Thank you for the opportunity to be of service to you. We trust that the information contained in this letter is satisfactory. Should you have any questions in connection with this report, we shall be pleased to discuss them with you.

For and on behalf of Coffey Geotechnics Inc.



Amit Patel, C.E.T., E.I.T.
Engineer in Training

Hafiz Muneeb Ahmad, M.Eng., P.Eng.
Associate Geotechnical Engineer

Appendix A:

Chemical Testing Results

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

CLIENT NAME: COFFEY GEOTECHNICS
20 METEOR DRIVE
TORONTO, ON M9W1A4

ATTENTION TO: Gennadiiy Iltchenko

PROJECT NO: GEOTETOB11546AA

AGAT WORK ORDER: 11T505943

SOIL ANALYSIS REVIEWED BY: Elizabeth Polakowska, MSc (Animal Sci), PhD (Agri Sci), Inorganic Lab Supervisor

DATE REPORTED: Jul 08, 2011

PAGES (INCLUDING COVER): 4

VERSION*: 1

Should you require any information regarding this analysis please contact your client services representative at (905) 712 5100, or at 1-800-856-6261

NOTES

All samples will be disposed of within 30 days following analysis. Please contact the lab if you require additional sample storage time.

Member of: Association of Professional Engineers, Geologists and Geophysicists of Alberta (APEGGA)
Western Enviro-Agricultural Laboratory Association (WEALA)
Environmental Services Association of Alberta (ESAA)

AGAT Laboratories is accredited to ISO/IEC 17025 by the Canadian Association for Laboratory Accreditation Inc. (CALA) and/or Standards Council of Canada (SCC) for specific tests listed on the scope of accreditation. AGAT Laboratories (Mississauga) is also accredited by the Canadian Association for Laboratory Accreditation Inc. (CALA) for specific drinking water tests. Accreditations are location and parameter specific. A complete listing of parameters for each location is available from www.cala.ca and/or www.scc.ca. The tests in this report may not necessarily be included in the scope of accreditation.

Results relate only to the items tested

AGAT Laboratories

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http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 11T505943

PROJECT NO: GEOTETOB11546AA

CLIENT NAME: COFFEY GEOTECHNICS

ATTENTION TO: Gennadiiy Iltchenko

O. Reg. 153 Metals & Inorganics in Soil - Table 1

DATE SAMPLED: Jun 25, 2011 | **DATE RECEIVED: Jun 29, 2011** | **DATE REPORTED: Jul 08, 2011** | **SAMPLE TYPE: Soil**

Parameter	Unit	G / S: A	G / S: B	G / S: C	RDL	BH-1 SS-2 2508873	BH-5 SS-1 2508876
Antimony	µg/g	1.3	40	40	0.8	<0.8[<A]	<0.8[<A]
Arsenic	µg/g	18	18	18	1	2[<A]	2[<A]
Barium	µg/g	220	670	670	2	77[<A]	24[<A]
Beryllium	µg/g	2.5	8	8	0.5	<0.5[<A]	<0.5[<A]
Boron	µg/g	36	120	120	5	8[<A]	<5[<A]
Boron (Hot Water Extractable)	µg/g		2	2	0.10	<0.10[<B]	<0.10[<B]
Cadmium	µg/g	1.2	1.9	1.9	0.5	<0.5[<A]	<0.5[<A]
Chromium	µg/g	70	160	160	2	17[<A]	8[<A]
Cobalt	µg/g	21	80	80	0.5	6.0[<A]	2.8[<A]
Copper	µg/g	92	230	230	1	12[<A]	6[<A]
Lead	µg/g	120	120	120	1	5[<A]	3[<A]
Molybdenum	µg/g	2	40	40	0.5	<0.5[<A]	<0.5[<A]
Nickel	µg/g	82	270	270	1	14[<A]	7[<A]
Selenium	µg/g	1.5	5.5	5.5	0.4	<0.4[<A]	<0.4[<A]
Silver	µg/g	0.5	40	40	0.2	<0.2[<A]	<0.2[<A]
Thallium	µg/g	1	3.3	3.3	0.4	<0.4[<A]	<0.4[<A]
Uranium	ug/g	2.5	33	33	0.5	<0.5[<A]	<0.5[<A]
Vanadium	µg/g	86	86	86	1	25[<A]	16[<A]
Zinc	µg/g	290	340	340	5	34[<A]	17[<A]
Chromium, Hexavalent	µg/g	0.66	8	8	0.2	<0.2[<A]	<0.2[<A]
Cyanide, Free	µg/g	0.051	0.051	0.051	0.05	<0.05[<A]	<0.05[<A]
Mercury	µg/g	0.27	3.9	3.9	0.01	<0.01[<A]	<0.01[<A]
Electrical Conductivity (2:1)	mS/cm	0.57	1.4	1.4	0.002	0.128[<A]	0.091[<A]
Sodium Adsorption Ratio (2:1)	N/A	2.4	12	12	N/A	0.254[<A]	0.180[<A]
pH, 2:1 CaCl2 Extraction	pH Units					7.64	7.85
Chloride (2:1)	µg/g				2	5	4
Nitrate + Nitrite	µg/g				1	<1	1

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: A Refers to T1 (ALL) - New, B Refers to T2 (ICC) - New, C Refers to T3(ICC) - New

2508873-2508876 EC, SAR, Chloride & Nitrate/Nitrite were determined on the extract obtained from the 2:1 leaching procedure (2 parts DI water:1 part soil). pH was determined on the extract obtained from the 2:1 leaching procedure (2 parts 0.01M CaCl2:1 part soil).

Certified By: Elizabeth Rolakowska

Results relate only to the items tested

AGAT Laboratories

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http://www.agatlabs.com

Quality Assurance

CLIENT NAME: COFFEY GEOTECHNICS

PROJECT NO: GEOTETOB11546AA

AGAT WORK ORDER: 11T505943

ATTENTION TO: Gennadiiy Iltchenko

Soil Analysis

RPT Date: Jul 08, 2011

PARAMETER	Batch	Sample Id	DUPLICATE			Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
			Dup #1	Dup #2	RPD		Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
O. Reg. 153 Metals & Inorganics in Soil - Table 1															
Antimony	1		< 0.8	< 0.8	0.0%	< 0.8	124%	70%	130%	103%	90%	110%	106%	70%	130%
Arsenic	1		3	3	0.0%	< 1	99%	90%	110%	101%	90%	110%	102%	70%	130%
Barium	1		54	60	10.5%	< 2	98%	90%	110%	100%	90%	110%	95%	70%	130%
Beryllium	1		0.5	0.6	18.2%	< 0.5	85%	80%	120%	101%	90%	110%	93%	70%	130%
Boron	1		< 5	< 5	0.0%	< 5	89%	80%	120%	109%	90%	110%	83%	70%	130%
Boron (Hot Water Extractable)	1		0.42	0.42	0.0%	< 0.10	99%	80%	120%	104%	90%	110%	106%	70%	130%
Cadmium	1		< 0.5	< 0.5	0.0%	< 0.5	94%	90%	110%	102%	90%	110%	95%	70%	130%
Chromium	1		18	20	10.5%	< 2	105%	90%	110%	106%	90%	110%	88%	70%	130%
Cobalt	1		6.3	6.5	3.1%	< 0.5	88%	80%	120%	90%	90%	110%	91%	70%	130%
Copper	1		10	11	9.5%	< 1	96%	90%	110%	101%	90%	110%	86%	70%	130%
Lead	1		9	9	0.0%	< 1	95%	90%	110%	97%	90%	110%	91%	70%	130%
Molybdenum	1		0.7	0.5	NA	< 0.5	105%	90%	110%	107%	90%	110%	106%	70%	130%
Nickel	1		15	15	0.0%	< 1	95%	90%	110%	101%	90%	110%	88%	70%	130%
Selenium	1		< 0.4	< 0.4	0.0%	< 0.4	117%	80%	120%	97%	90%	110%	89%	70%	130%
Silver	1		< 0.2	< 0.2	0.0%	< 0.2	84%	80%	120%	96%	90%	110%	92%	70%	130%
Thallium	1		< 0.4	< 0.4	0.0%	< 0.4	94%	90%	110%	97%	90%	110%	99%	70%	130%
Uranium	1		< 0.5	< 0.5	0.0%	< 0.5	97%	90%	110%	93%	90%	110%	103%	70%	130%
Vanadium	1		26	27	3.8%	< 1	95%	90%	110%	95%	90%	110%	94%	70%	130%
Zinc	1		40	42	4.9%	< 5	91%	90%	110%	106%	90%	110%	83%	70%	130%
Chromium, Hexavalent	1		< 0.2	< 0.2	0.0%	< 0.2	99%	80%	120%	103%	90%	110%	103%	70%	130%
Cyanide, Free	1		< 0.05	< 0.05	0.0%	< 0.05	93%	80%	120%	104%	90%	110%	104%	70%	130%
Mercury	1		0.02	0.02	0.0%	< 0.01	99%	80%	120%	102%	90%	110%	110%	70%	130%
Electrical Conductivity (2:1)	1		0.415	0.429	3.3%	< 0.002	93%	80%	120%						
Sodium Adsorption Ratio (2:1)	1		8.24	8.64	4.7%	N/A									
pH, 2:1 CaCl2 Extraction	1		7.85	7.79	0.8%	<	105%	90%	110%						
Chloride (2:1)	1		560	522	7.0%	< 2	96%	90%	110%	100%	90%	110%	97%	70%	130%

Comments: RPD Qualifier: As the average Mo value of the sample and a duplicate is less than 5 X RDL lab's 30% RPD acceptance criteria is not applicable (NA).

Certified By: Elizabeth Rolakowska

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Method Summary

CLIENT NAME: COFFEY GEOTECHNICS

AGAT WORK ORDER: 11T505943

PROJECT NO: GEOTETOB11546AA

ATTENTION TO: Gennadiiy Iltchenko

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Soil Analysis			
Antimony	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Arsenic	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Barium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Beryllium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Boron	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Boron (Hot Water Extractable)	MET-93-6104	EPA SW 846 6010C; MSA, Part 3, Ch.21	ICP/OES
Cadmium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Chromium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Cobalt	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Copper	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Lead	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Molybdenum	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Nickel	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Selenium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Silver	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Thallium	MET-93-1003	EPA SW 846 3050B & 6020A	ICP-MS
Uranium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Vanadium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Zinc	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Chromium, Hexavalent	INOR-93-6029	SM 3500 B; MSA Part 3, Ch. 25	SPECTROPHOTOMETER
Cyanide, Free	INOR-93-6052	MOE CN-3015 & E 3009 A;SM 4500 CN	TECHNICON AUTO ANALYZER
Mercury	MET-93-6101	EPA SW 846 7471A 245.5	CVAAS
Electrical Conductivity (2:1)	INOR-93-6036	McKeague 4.12, SM 2510 B	EC METER
Sodium Adsorption Ratio (2:1)	INOR-93-6007	McKeague 4.12 & 3.26 & EPA SW-846 6010C	ICP/OES
pH, 2:1 CaCl2 Extraction	INOR-93-6031	MSA part 3 & SM 4500-H+ B	PH METER
Chloride (2:1)	INOR-93-6004	McKeague 4.12 & SM 4110 B	ION CHROMATOGRAPH
Nitrate + Nitrite	INOR-93-6004	McKeague 4.12 & SM 4110 B	ION CHROMATOGRAPH

Results relate only to the items tested

AGAT Laboratories

25.5. SR11 Outside

5835 Coopers Avenue
Mississauga, Ontario; L4Z 1Y2
Phone: 905-712-5100; Fax: 905-712-5122
Toll free: 800-856-6261
www.agatlabs.com
http://webearth.agatlabs.com

CHAIN OF CUSTODY RECORD

LABORATORY USE ONLY
Arrival Conditions: ☐ Good ☐ Poor (complete "notes")
Arrival Temperature: 11.4 AGAT WO #: 11T505943
Notes:

Client Information
Company: Coffey Geotechnics
Contact:
Address: Etobicoke
Phone: 416-213-1255 Fax: 416-213-1260
Project: GEOTE~~TOB 11 5464-A~~ PO:
AGAT Quotation #:
Please note, if quotation number is not provided, client will be billed full price for analysis.

Invoice To Same as Above? (Yes) / No (circle)
Company:
Contact:
Address:
Phone: Fax:

Report Information - reports to be sent to:
1. Name: Gennadiy Ilchenko
Email: gennadiy.ilchenko@coffey.com
2. Name: Ramesh Khatiwada
Email: ramesh.khatiwada@coffey.com

Regulatory Requirements
NOW Reg. 511/09
☑ Regulation 153 Table 1 2 3 (Indicate one)
☑ Ind/Com
☑ Res/Park
☐ Agriculture
Soil Texture (check one): ☐ Coarse ☐ Med/Fine
☐ Sewer Use Region (Indicate one) ☐ Sanitary ☐ Storm
☐ Regulation 558
☐ CCME
☐ Other (indicate)
☐ Prov. Water Quality Objectives (PWQO)
☐ Nutrient Management Act (NMA)

Is this a drinking water sample (potable water intended for human consumption)? ☐ Yes ☒ No (If "Yes", please use the Drinking Water Chain of Custody Record)

Report Format
☐ Single Sample per page
☑ Multiple Samples per page
☐ Results by fax

Turnaround Time (TAT) Required*
Regular TAT:
☑ 5 to 7 Working Days
Rush TAT: (please provide prior notification)
Rush Surcharges Apply
☐ 3 to 5 Working Days
☐ 2 Working Days
☐ 1 Working Day
OR
DATE REQUIRED (Rush surcharges may apply):
*TAT is exclusive of weekends and statutory holidays

Sample Identification	Date Sampled	Time Sampled	Sample Matrix	# of Containers	Comments Site/ Sample Information	Metals and Inorganics	Metal Scan (excl. Hg, B, Cr6)	CCME Fractions 1 to 4	VOCs	PAHs	PCBs	TCLP Metals/Inorganics	TCLP	Storm Sewer Use	Sanitary Sewer Use						LABORATORY USE ONLY LAB SAMPLE ID
BH-1 SS-2	June 27, 2011		Soil	1 bag		✓															
BH-5 SS-1	June 25, 2011		"	1 bag		✓															
				2																	

Samples Relinquished By (print name & sign): [signature] Date/Time: June 28/11
Samples Relinquished By (print name & sign):
Samples Received By (print name & sign): [signature] Date/Time: June 29/11
Samples Received By (print name & sign): Date/Time: 1:20 5:35

Pink Copy - Client
Yellow + Golden Copy - AGAT
White Copy - AGAT

PAGE ____ of ____
NO: 147474

Cedarvale Community School
Classroom and Gymnasium Addition
145 Ava Road, York, Ontario

Mechanical, Electrical &
Communications Specifications
Issued for Tender – September 06, 2011

Taylor_Smyth **architects**

Consulting Engineers

Smith + Andersen
Mechanical Consultant
Electrical Consultant
Communications Consultant

Smith + Andersen
4211 Yonge Street Suite 500 Toronto Ontario M2P 2A9
416 487 8151 f 416 487 9104 smithandandersen.com

MECHANICAL SPECIFICATION

FOR

CERAVALE CS PHASE 2
CLASSROOM ADDITION
145 AVA ROAD, TORONTO, ON
-1ST FLOOR

THIS SPECIFICATION SHALL BE READ IN CONJUNCTION WITH DRAWINGS:

TM-0.1, TM-0.2, TM-0.3 TM-1.2, TM-1.3, TM-1.4, TM-1.5

OUR PROJECT NUMBER:

10258.003.M.001

DATE:

2011.09.06

ISSUED FOR PERMIT / TENDER

MECHANICAL SPECIFICATION

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MECHANICAL SPECIFICATION

1. GENERAL

1.1. The drawings and specifications shall be read in conjunction with base building drawings and specifications. The base building design documents are available for review at the Building Managers Office. The most stringent requirements will apply.

1.2. Visit the site prior to tender and verify all conditions. Prior to submitting price, the mechanical contractor is to review all discrepancies with the Consultant and verify the locations of all existing services that are being extended and the routing of new services. Also report all ambiguities, discrepancies, departures from building by-laws and/or from good practice. Failure to do so will result in all additional costs being the responsibility of the Mechanical Contractor. Include for any alternate routing of new or rerouting of existing services to accommodate all site conditions in the tender price.

1.3. All work shall be in accordance with the requirements of all governing authorities, codes and local by-laws. Comply with local Codes and Bylaws, Building Act (BCA) and Ontario Building Code (OBC) including:

BCA: 1.1 (3) Role of Builders: it is the role of a Builder,

- To ensure that construction does not proceed unless any permit required under this Act has been issued by the chief building official;
- To construct the building in accordance with the permit;
- To use appropriate building techniques to achieve compliance with this Act and the Building Code; and
- When site conditions affect compliance with the Building Code, to notify the designer and an inspector or registered code agency, as appropriate.

BCA: 8 (13) Prohibition

- No person shall construct or demolish a building or cause a building to be constructed or demolished except in accordance with the plans, specifications, documents and any other information on the basis of which a permit was issued or any changes to them authorized by the chief building official.

OBC Part C – 1.3.5.1(2) Prescribed Notices

- Substantial completion of rough-in of heating, ventilation, air-conditioning and air contaminant extraction equipment,
- Substantial completion of all fire protection systems including standpipe and sprinklers
- Readiness for inspection and testing of:
  - Building sewers and building drains
  - Water service plans
  - Drainage and vent systems
  - The water distribution system and,
  - Plumbing fixtures and appliances

1.4. All work shall be done in accordance with the approved construction schedule and all specified interim schedules. Contractor must comply with the General Contractor's Construction Schedule.

1.5. All work must comply with TDSB Guidelines where applicable.

1.6. Clean up, remove from site, and dispose of all debris created by this Division in accordance with all applicable regulations and by-laws.

1.7. Apply for, obtain and pay for all permits and inspections required prior to commencement of construction. Include all sales taxes and the GST or HST, as applicable.

1.8. Co-ordinate the mechanical work with all trades installing equipment which may affect the mechanical work. The location of all new equipment and the routing of all new services shall be co-ordinated with and agreed upon by all trades that may be affected. Any additional costs resulting from the lack of on site co-ordination shall not be the responsibility of the Client.

1.9. Provide written warranty for all labour, materials, and equipment provided in this contract, for a period of one year commencing at such time that the Consultant deems the work acceptable.

1.10. Obtain CAD drawing document files and one set of white prints. Mark prints to accurately indicate installed work and transfer all information at the completion of construction onto as-built CAD documents files, after marked-up prints have been reviewed by the Consultant. Upon completion of the work submit the completed record drawings and CAD disk to the Consultant, with one set of as-built prints for review.

1.11. All shutdown, draining and filling of any portion of the existing base building systems shall be performed by TDSB's building operations staff and shall be co-ordinated with TDSB for time and duration of interruptions. Comply with all of TDSB's instructions, and include for all costs for this work in the tender price.

1.12. Include the cost of premium time in the Tender Price for work provided during nights, weekends or other times outside normal working hours, necessary to maintain all mechanical services in operation and to meet the project schedule.

1.13. Check for any interferences in ceiling space of floor below and/or below floor slab in all areas requiring core drilling to the approval of TDSB.

1.14. Alternate equipment may be proposed during the Tender period, provided that the space requirements, quality and performance characteristics, power characteristics, air and fluid flow requirements and weights are equal to the specified products. Acceptance of alternate equipment shall be at the discretion of the Consultant and will only be after review of properly submitted shop drawings. Assume responsibility and pay for all additional installation costs incurred by all related trades resulting from alternates and/or substitutes. This shall include changes to flow rates affecting pipe sizes, electrical power requirements, structural reinforcement and ductwork revisions. No additional costs will be accepted. Make revisions to Record Drawings, incorporating alternates and/or substitutes and all related changes. Alternate equipment will not be considered subsequent to tender closing.

1.15. Provide shop drawings for all specified equipment and submit for review by the Consultants. Equipment shall not be ordered or installed until shop drawings have been reviewed or stamped “reviewed” by Smith + Andersen.

1.16. Reuse existing materials and equipment wherever possible. Provide new materials and equipment as required to ensure a complete installation. All existing equipment, materials and associated controls not used in this contract shall be packaged and turned-over to

TDSB. Include in the tender for all shipping and placement in a designated on-site storage location. Remove any equipment or material not wanted by TDSB from the site.

1.17. All cutting and patching of masonry/concrete floors, walls, and roof for mechanical services shall be by this Division. Obtain approval from TDSB before cutting any structural walls or floors. Cutting and drilling shall only be at times allowed by TDSB. Check and verify the location of existing mechanical and electrical services in walls and below the floor slab in all areas requiring core drilling and cutting. Protect all tenant areas where core drilling occurs. Carefully chip top and bottom of slab to expose rebars to minimize cutting of rebars when core drilling. Provide x-ray study before drilling or cutting where required by TDSB.

1.18. Provide sleeves for all new piping passing through floor and roof slabs, beams, concrete walls and slab to slab partitions, etc.

1.19. Seal to be air-tight around all ductwork and piping penetrations through partitions, baffles above ceilings, and through floors that are not fire rated.

1.20. All annular spaces between mechanical services and sleeves through fire rated floor and wall openings, shall be packed with an approved fire stopping material insulation and shall be sealed with an approved fire stop equal to "Dow Corning" silicon sealant.

1.21. All sprinkler, standpipe and other fire and life safety protection services shall remain in operation at all times. When work is performed on these systems, notify the fire department and TDSB, and at the end of each work period (prior to leaving the site), cap the open ends of the system and reactivate as necessary. All work must be arranged through TDSB.

1.22. Provide all access doors where required to service all new and existing equipment. Access doors shall be equal to LeHage and shall be compatible with ceiling/wall type and finish. Doors located in drywall ceilings shall be recessed type with a drywall infill panel, and shall be flush with the surrounding finishes. Mechanical services are to be co-ordinated to minimize the number of access points. Co-ordinate location and sizes with the Consultant. Provide a drawing for review indicating the size and location of all doors before proceeding with the installation.

1.23. Provide three operating and maintenance manuals each containing data sheets, brochures, operating and maintenance information, recommended spare parts lists, lubricating instructions and air and water balancing report, and start up certificates of A/C units. Include a "reviewed" set of shop drawings and bind in hard covers with "Operating and Maintenance Manual" title on cover. Submit a sample manual to the consultant for review before submitting three copies to the tenant.

1.24. Identify each pipe and duct run complete with directional flow arrows. Locate identification no more than 40 ft. (12 m) apart. Use 2 in. (50 mm) high lettering. Match the base building identification system where applicable. Also provide valve tag and equipment name plates to match base building format and numbering system. Identify each fan, pump, A/C unit, etc., with an engraved lamacoid nameplate, white letters on black background, mechanically attached. Provide charts of all valve tags.

1.25. Vibration isolation shall be provided for all pumps, fans, A/C units, etc., as required to comply with base building standards.

1.26. Request in writing for a completed rough-in and final inspection of the mechanical systems. When the final inspection request is made all deficiencies must be complete, balancing

reports submitted, systems ready for operation, equipment has been commissioned, operating and maintenance manuals submitted, all tags, charts and nameplates completed, all fixtures and equipment cleaned, spare parts provided, record drawings complete, control systems operational and TDSB's staff instructed in all phases of the system operation.

1.27. All power wiring and equipment starters for mechanical equipment and associated devices including connections shall be provided under the Electrical Contract, Division 16, unless noted otherwise in the specification. Confirm the power characteristics on site prior to processing shop drawings and ordering equipment. All control wiring, line or low voltage, shall be by this Contractor.

1.28. Provide temporary filters, 1 in. thick disposable media type, over all return air openings in the base building H.V.A.C. systems that remain in operation during construction. Maintain and replace the temporary filter media as required to prevent construction dust from fouling the base building equipment. Remove same at the completion of construction. Filters in all base building air handling equipment i.e., Air Handling Units, Induction Units, Fan Coil Units, etc., shall be replaced after construction is completed.

1.29. Prior to operating any existing or new equipment during any stage of construction, approval from TDSB and Consultant must be received in writing.

1.30. Provide all rigging as may be required for all system materials and equipment. Provide all required supplementary steel supports necessary for mounting or hanging equipment. Equipment being suspended from the floor structure, or supported from or on the roof shall have supports reviewed by a structural consultant. All required structural supports or structural reinforcing, as recommended by the Consultant, shall be included in the tender.

1.31. All new and relocated existing services and equipment must be supported from the building structure. All drilling, approved type inserts and hangers shall be included:

- Auxiliary structural members shall be included and installed where required to accommodate hangers
- All supports shall be connected to the top of joists and beams where applicable.
- Suspension from metal deck is not allowed.
- Suspending one hanger from another is not permitted.

1.32. Provide a complete itemized cost breakdown of all materials, equipment and labour costs associated with each submission for additional or deleted work.

2. **SCOPE OF WORK**

2.1. Scope of work shall include but not be limited to, the furnishing of labour, materials, tools and equipment required to provide a complete installation and the testing of all systems shown on the drawing and specified herein including:

General Requirements
Demolition
Testing and Balancing
Plumbing and Drainage
Fire Protection
Ventilation
Heating and Air Conditioning
Insulation
Automatic Controls

3. **TESTING AND BALANCING**

3.1. Prior to commencement of any work, check and verify on site, the total supply air quantity and available static pressure presently available from the main supply air ducts and/or the fan serving the project area and report the test results to the Consultant.

3.2. Test, balance and adjust all air systems to obtain +\-5% of the design air quantities. Confirm the appropriate operation and calibration of all thermostats existing and new and report all deficiencies. Mark the final balance position on all noted balancing dampers after final adjustment of air turning and balancing devices. Provide a deficiency report to the Contractor prior to finalizing the testing and balancing report to the Consultant, with all noted deficiencies resolved. Submit three (3) copies of the final air systems test and balance report to the Consultant. Indicate all test results including coil entering and leaving air temperature, closest and furthest outlet supply air temperatures, and room temperatures for all air systems.

3.3. Test, balance and adjust all fluid systems to obtain ±5% of the design flow rates and temperature rises/drops across, coils, pumps and heat exchangers. Mark the final balance position on all valves after final adjustment of balancing valves and balance fittings. Provide a deficiency report to the Contractor prior to finalizing the testing and balancing report to the Consultant, with all noted deficiencies resolved. Submit three (3) copies of the final fluid systems test and balance report to the Consultant. Indicate all test results including entering and leaving water temperatures, pressures, and measured flow rates of all pumps, heating/cooling elements, coils and heat exchangers.

3.4. Adjust all deflection blades on new and existing supply air grilles and diffusers, to ensure that air pattern is horizontal across the ceiling.

3.5. Where supplementary cooling units are connected to city water for cooling, adjust the water regulating valve/leaving water temperature, to reduce water consumption to the optimum amount.

3.6. Include for one additional 2 days (16 hours) of fine tuning as may be required to accommodate tenant specified requirements. This final adjustment may be required any time within the first six months of occupancy.

3.7. This work shall be performed by an Independent Testing and Balancing Contractor approved by TDSB:

- Ace Commercial AirTest & Balancing
- Design Test & Balance
- Pro Air Test
- V.P.G. Associates

3.8. Include all costs in the Tender Price.

4. **INSULATION**

4.1. Cover all domestic hot and cold water, with 1/2 in. (12mm) finished thickness, and heating and chilled water piping with 1 in. (25 mm) finished thickness, pre-moulded low pressure glass fibre insulation (5.5 lbs. density). For domestic cold water and chilled water piping use a vapour barrier jacket.

4.2. Provide pipe size hangers and insulate over hangers and 4 in. up hanger rods on cold and chilled water lines. Provide over-sized hangers with hangers positioned over the insulation on pipes larger than 2 in. dia. Where condenser water lines are provided with city water back-up, insulate all supply lines exposed to city water.

4.3. Cover all fittings, valves, water meters and appurtenances with 1 in. (25 mm) blanket insulation or Armaflex. Seal insulation for cold water fittings with a vapour barrier adhesive and reinforce with glass open weave fibre tape and finish smooth with a coat of mastic.

4.4. All horizontal indirect condensate drainage piping shall be covered with 1/2 in. (12 mm) finished thickness fibreglass dual temperature insulation, with factory applied, fire resistive fibreglass reinforced kraft paper and aluminium foil vapour barrier or equal. Where condensate lines route into a direct drain, insulate the trap and first 20 feet of direct drain.

4.5. Make good all existing insulation, where damaged, when connecting to existing services. Where existing insulation has been previously removed, or is in a state of disrepair, bring this item to the consultant's attention.

4.6. Where insulated piping is exposed, provide PVC jacketing conforming with the flame and smoke spread ratings required by code and as supplied by ACWIL Insulations Ltd. As an alternative, provide canvas covering with two applications of sizing.

4.7. Insulate all exhaust and outside air intake plenums at louvres or hoods. Insulate all ductwork for a minimum length of 10 feet on the building side of the associated motorized exhaust dampers and the entire length of the outside air intake duct. Use 1 in. (25 mm) finished thickness rigid insulation board with vapour barrier, and where exposed to view cover with canvas.

4.8. All piping, carrying fluids subject to freezing, routing outside the building, or in spaces subject to freezing temperatures, shall be electrically traced by Division 16 and insulated with 2 in. thickness fibreglass insulation and covered with a weatherproof PVC or aluminium jacket.

4.9. Insulation jacket for services and ductwork exterior to the building, and for indoor components such as valves, pump, meters, etc., shall be Childers or Armacell field applied U.V. protected mesh reinforced mastic.

- Mastic shall be equal to Childers VI-CRYL CP-10/11 weather barrier coating. Finish shall be white.
- Sealant for areas where mastic meets adjoining insulated or uninsulated surfaces or dissimilar weather proofing materials shall be equal to Childers CP-76.
- Glass fibre reinforcing mesh for thickness control and strength at joint interfaces in field applied mastic on exterior ductwork insulation shall be equal to Childers CHIL-GLAS #10.

4.10. Insulation and vapour barrier shall be continuous at all fittings, hangers and through walls or floors.

4.11. Tape all joints and seams and band at 16 in. (350mm) intervals.

4.12. Staples shall not be used for securing insulation.

4.13. Test all piping and seal all duct joints with duct sealer before applying insulation. (Where ducts are not 100% air tight, insulation will pressurize, and open at joints and separate from the duct.)

4.14. All insulation materials to be supplied by Owens-Corning, Certainteed-Mason, Knauf or Partek.

5. **PLUMBING**

5.1. Pipes and fittings shall be in accordance with the following unless specified otherwise by local authorities.

5.2. All city and domestic water, above grade, 75 mm (3 in.) and smaller, less than 1380 kPa (200 psi) working pressure:

1. Pipe: Copper Tubing, Type "L", Hard Drawn, ASTM B88. Fittings: wrought copper solder joint pressure fittings, ANSI/ASME B16.22 or cast copper alloy solder joint pressure fittings, ANSI/ASME B16.18.
2. Joints made with 95-5 tin antimony, 96-6 tin silver, or 96-4 tin silver solder, ASTM B32.
3. Grooved end copper fittings conforming to ASTM B75 etc.
4. Couplings to be designed with angle bolt pads to provide a rigid joint.
5. Installation ready for direct stab installation without field disassembly, complete with grade EHP gasket, rated for -35 deg. C. to 121 deg. C. (-30 deg. F. to 250 deg. F. Victaulic 607.
6. Copper tubing standard coupling complete with EPDM flush seal gaskets rated for -35 deg. C. to 110 deg. C. (-30 deg. F. to 230 deg. F.) Victaulic 606.
7. Butterfly valves, bubble-tight service up to 2065 kPa (300 psi) with bronze body Victaulic 608.
8. Gate valves, 860 kPa (125 psi) WSP or 1380 kPa (200 psi) non-shock WOG with bronze body, rising stem screwed. Crane #428, Jenkins #810J, Toyo 293 or Kitz 24, for threaded ends or Crane #1334, Jenkins #813J, Toyo 299 or Kitz 44 for solder ends.
9. Globe valves, 860 kPa (125 psi) WSP or 1380 kPa (200 psi) non-shock WOG with bronze body, solder ends or with screwed to solder adapter and composition disc for water service. Crane #1310, Jenkins #106BPJ, Toyo 222 or Kitz 10.
10. Check valves 860 kPa (125 psi) WSP or 1380 kPa (200 psi) non-shock WOG with bronze body, swing check, solder ends. Crane #1342, Jenkins #4093J, Toyo 237 or Kitz 23.
11. Non-slam check valves downstream from pumps, ANSI Class 150, 1032 kPa (150 psi) WSP pressure rating, dual flapper design with 316 stainless steel body and stainless steel check, renewable disc and resilient seat for flanged installation. Non-slam check valves shall be Velan-ProQuip Model DDD11-1D, Duo CHEK II H15CMF3-14.
12. Strainers shall be Bronze Y body equal to Colton Industries Model 125YTB, Mueller 351M.
13. Drain valves and blow-off valves shall be 4137 kPa (600 psi) WG 19 mm (3/4 in.) ball valves with bronze body or forged brass body, solid ball, male threaded garden hose end, brass cap and chain equal to Watts B-6000, Toyo 5046, Kitz 58CC or Apollo 78-100.
14. Hose bibs shall be for 1380 kPa (200 psi) non-shock, bronze body with composition disc and 19 mm (3/4 in.) garden hose thread, complete with a U.L.C. vacuum breaker.

5.3. All domestic water above grade 75 mm (3 in.) and smaller, over 1380 kPa (200 psi) working pressure and under 2070 kPa (300 psi) working pressure:

1. Pipe: Copper Tubing, Type "L", Hard Drawn, ASTM B88.

2. Joints, brazed
3. Grooved end copper fittings conforming to ASTM B-75.
4. Couplings to be designed with angle bolt pads to provide a rigid joint.
5. Installation ready for direct stab installation without field disassembly, complete with grade EHP gasket, rated for -35 deg. C. to 121 deg. C. (-30 deg. F. to 250 deg. F. Victaulic 607.
6. Copper tubing standard coupling complete with EPDM flush seal gaskets rated for -35 deg. C. to 110 deg. C. (-30 deg. F. to 230 deg. F.) Victaulic 606.
7. Butterfly valves, bubble-tight service up to 2065 kPa (300 psi) with bronze body. Victaulic 608.
8. Gate valves, 1035 kPa (150 psi) WSP or 2070 kPa (300 psi) non-shock WOG, bronze body solder ends or screwed to solder adapter. Crane #1334, Jenkins #813J, Toyo 299 or Kitz 43.
9. Globe valves, 1035 kPa (150 psi) WSP or 2070 kPa (300 psi) non-shock WOG, bronze body solder ends or screwed to solder adapter, composition disc. Crane #7TF, Jenkins #106BPJ, Toyo 222 or Kitz 10.
10. Check valves, 1380 kPa (200 psi) WSP or 2760 kPa (400 psi) non-shock WOG, bronze body swing check, solder or screwed ends to solder adapters, Crane #36, Jenkins #4449, Toyo 360, Kitz 19.
11. Non-slam check valves downstream from pumps, dual flapper design with stainless steel body, check, renewable disc and resilient seat for flanged installation equal to Pro-Quip 2070 kPa (300 psi) pressure rating model 4DD111, Duo CHEK II S-3 G30-CPF 559, or Mueller Sure Check #74-HHH-6-H.
12. Strainers shall be bronze Y body equal to Colton Industries model B509 or Mueller 352M.
13. Drain valves and blow-off valves shall be 4137 kPa (600 psi) WG 19 mm (3/4 in.) ball valves with bronze or forged brass body, solid ball, virgin teflon seat and packing, male threaded hose end, cap and chain. Equivalent to Watts B-6000, Toyo 5046, Kitz 58CC or Apollo 78-100.

5.4. Storm and sanitary drains and vents above grade shall be cast iron or copper pipe installed as in regulations, except where copper pipe is used, joints to be made with 95-5 solder. ABS and PVC pipes are not acceptable.

5.5. Vent stack covers shall be equal to Thaler Metal Industries SJ-24/SJ-25 and shall be 1100-0T alloy aluminum with vandal proof removable cap and EPDM base seal, pvc coated deck flange or bituminous deck flange as required to suit roof membrane.

5.6. Buried storm and sanitary inside the building shall be Class 4000 grey cast iron soil pipe, black bituminous coating, fittings and means of joining to meet the requirements of CAN/CSA B70. Mechanical couplings for drain, waste, vent pipe and sewer pipe to meet the requirements of CAN/CSA B602. Bituminous fibre, vitrified clay, ABS and PVC pipe are not acceptable.

5.7. Buried storm and sanitary inside the building shall be SDR 28 rigid for 100mm (4 in.) to 150mm (6 in.), SDR 35 for 200mm (8 in.) and larger, green PVC gasketed hub and spigot pattern sewer pipe and injection molded and fabricated gasketed fittings to meet the requirements of CAN/CSA B182.2 with assembled with PVC pipe lubricant.

5.8. All embedded pipe and materials in parking structures and ramps shall meet the requirements of CAN/CSA S413-94 for corrosion resistant materials or shall have a corrosion resistant coating.

5.9. Field tile shall be vitrified clay pipe or No-Co-Rode pipe.

5.10. Butterfly valves may be used in lieu of gate valves in size 65 mm (2-1/2 in.) and over in systems 1380 kPa (200 psi) and less. Where specifically shown on drawings, butterfly valves must be used. Install between 860 kPa (125 psi) flanges.

1. Valves shall have iron body, one piece or split alloy steel shaft, top and bottom bearings, bronze disc or iron disc with stainless steel trim and resilient elastomer replaceable seat with integral reinforcing ring or keyed to body.
2. Body shall have threaded lugs.
3. Valve shall have bubble tight shut-off to 1035 kPa (150 psi) pressure in either direction when the piping and connecting flange is removed from one side of the valve.
4. Valves 100 mm (4 in.) and smaller shall have lever operator with lock.
5. Valves larger than 100 mm (4 in.) shall have worm gear manual operator with indication of valve opening.
6. Butterfly valves shall be equal to Keystone Model 222-784, Dezurik Model BGS, Challenger Model 20-CN4E, Bray Series 31, Apollo 143 Series, Kitz 61 Series, Centreline 200 or Crane 44.
7. Butterfly valves for grooved end systems shall be Victaulic 608.

5.11. Back-flow preventers for connection to wall hydrants, hose bibbs, hot water heating systems, and similar uses, shall be Watts No. 9 or 909 or Hersey-Beeco with C.S.A. listing.

5.12. Double check valve backflow preventers shall be complete with OS&Y gate valves, replaceable seats, spring loaded check valves, serviceable in-line equal to Zurn-Wilkens Model 950. Maximum pressure drop shall be 34 kPa (5 psi) at 31.5 L/s (500 g/m).

5.13. Ball valves 50 mm (2 in.) and smaller shall be bronze body or forged brass 4137 kPa (600 psi) WOG, virgin Teflon seat, TFE stem packing and thrust washer, 1/4 turn open-closed operation with solid ball. Ball valves shall be Watts No. B-6000, Toyo 5044A/5049A, Kitz 58/59 or Apollo 70-100/200. Stem extensions shall be provided on all ball valves. Ball valves may be substituted for gate valves only.

5.14. Except where special feature are required or unless otherwise approved or noted, all valves shall be of one manufacturer with the manufacturer's name and the pressure rating clearly marked on the outside of the valve body. Valves shall be manufactured by Crane, Jenkins, Toyo or Kitz. Butterfly valves shall be by Keystone, DeZurik, Bray, Challenger, Centerline, Crane, Apollo, Kitz or Victaulic. Non-slam check valves shall be Pro-Quip, Duo CHEK II, Centerline, Mueller or Victaulic. Ball valves shall be Apollo, Watts, Crane, Jenkins, Toyo or Kitz. Valves shall be equal to the model numbers specified.

5.15. Pressure reducing valves 65 mm (2-1/2 in.) and larger shall be equal to Cla-Val 790-01 with capacity shown and a pressure drop not exceeding 70 kPa (10 psi) under full flow. Valve shall maintain downstream pressure within a range of plus or minus 35 kPa (5 psi). Required outlet pressure, inlet pressure and flow rate as shown.

1. This valve shall maintain a constant downstream pressure regardless of fluctuations in demand and shall also prevent a pressure rise when demand is zero.

2. Valve shall be single-seated, hydraulically operated, pilot controlled diaphragm type globe valve. Valve stem shall be top and bottom guided and shall be actuated by a resilient diaphragm. Valve body and cover shall be cast iron, flanged. Trim shall be bronze type. Valve seat shall be replaceable. There shall be no external packing glands.
3. Pilot control shall be a direct acting, adjustable, spring-loaded valve with bronze body and stainless steel trim.
4. Main valve, pilot control valve and all trim shall be factory-assembled into one unit.
5. Valve shall be Class 125 for low pressure systems less than 1380 kPa working pressure and Class 250 for high pressure systems greater than 1380 kPa (200 psi) working pressure.
6. Pressure reducing valves 50 mm (2 in.) and smaller shall be Cash Acme or Watts equal to Watts UB5 bronze body, screwed. Rating of valve shall be 2070 kPa (300 psi) at 71 deg. C. (160 deg. F.).
7. See drawing for capacities and operating pressures.

5.16. Combination pressure reducing and check valve shall be Cla-Val 790-01-D and shall be as specified for the pressure reducing valve, but with an integral check valve.

5.17. Backwater valves shall be by J.R. Smith, Zurn, Mifab, or Watts. Valves shall be complete with cast iron body and bolted cover, bell inlet, spigot outlet, bronze double fulcrum top hung revolving flap and bronze valve seat.

1. Unit up to 300 mm (12 in.) below grade, shall be complete with access cover at grade and extension sleeve between cover and valve casing.
2. Unit more than 300 mm (12 in.) below grade, shall be complete with minimum 600 mm (24 in.) dia. galvanized steel, concrete or vitrified clay tile access pit with 600 mm (12 in.) dia. heavy duty scoriated manhole cover and frame.

5.18. Water hammer arresters shall be stainless steel bellows type and shall bear the Plumbing and Drainage Institute seal of approval. JR Smith 5000 Series, Zurn Z-1700, Mifab WHB, Watts SS Series. Piston type shall not be acceptable.

5.19. Gate valves in sanitary drains shall be equal to Seguro rubber sealed, cast iron, Class 150, ASA B16.10, with ASA B16.1 flanged ends, with OS&Y rising stem operation.

5.20. Exterior site sewers shall be PVC non-pressure, SDR 28, asbestos cement, or concrete of class and type to suit depth of trench and bedding. PVC non-pressure sewer piping shall be Ipex or Canron for sizes 100 mm (4 in.) to 150 mm (6 in.) conforming to CSA B182.1 ASTM D 3034. For sizes 200 mm (8 in.) to 375 mm (15 in.) shall be Canron conforming to CSA B182.2 and ASTM D3034. For size 450 mm (18 in.) to 1200 mm (48 in.) shall be Ipex or Canron conforming to CSA B182.4 and ASTM F794. Sewers shall be laid in accordance with manufacturers instructions and in accordance with Sub-section 3.5 of Regulation 815/84 the O.W.R.A. (Ontario Plumbing Code).

5.21. Exterior site PVC pressure piping shall be Ipex or Canron Blue-Brute conforming to AWWA-C900 and CSA B 137.3 standards laid in accordance with the manufacturers instructions and in accordance with Sub-section 3.5 of Regulation 815/84 of the O.W.R.A. (Ontario Plumbing Code).

5.22. Storm drainage piping from manhole outside building to creek, drainage course, may be corrugated galvanized steel using Armco standard round corrugated steel culvert.

5.23. Thermostatic mixing valves

1. Thermostatic mixing valves shall be Lawler Series High-Low Water Mixer 804 combination thermostatic and pressure balanced water controller, 38mm (1-1/2 in.) inlet and 50 mm (2 in.) outlet, liquid filled motor. The valve shall maintain output temperature for changes in inlet pressure and temperature. Valve construction shall be bronze body and stainless steel piston and liner. Mixing valve shall include a union end stop and check valve with removable strainer on each inlet. Complete with 0 – 200 deg. F. dial thermometer and shut off valve on tempered water outlet.

5.24. Valves shall be provideD as shown and as required for the satisfactory operation and control of all equipment and shall be installed to enable each piece of equipment to be isolated.

5.25. Gate valves shall be installed at the base of each riser and at each branch take-off. Where the equipment is to be isolated within easy view of and not more than 6000 mm (20 ft.) from the main, at the branch take-off, then the branch take-off valve may serve as the equipment isolating valve.

5.26. Drain valves shall be installed at each low point in the piping systems and at each tank.

5.27. Blow-off valves shall be provided on each 65 mm (2-1/2 in.) strainer and larger.

5.28. Globe valves shall be installed as shown and in each bypass.

5.29. Back-flow preventers shall be installed for connections to wall hydrants, hose bibbs, hot water heating systems, as shown on drawings, and any other connection to potable water systems in which backflow may occur, shall be Watts No. 9 or 909 or Hersey-Beeco with CSA listing. Where hose bibbs and wall hydrants are provided with an approved vacuum breaker the back-flow preventer is not required. An approved double check valve device may be used in lieu of a back-flor preventer where approved by CSA.

5.30. Check valves shall be installed as shown and where required to prevent backflow.

5.31. Buried piping shall be of a class and type and laid in a bedding as noted and/or as recommended by the manufacturer and any authority having jurisdiction. Class of pipe and bedding shall take into consideration location, size of pipe, type, width and depth of trench and type of soil.

1. Bedding types shall be Class A or Class B as detailed Standard Drawings for concrete, vitrified clay or asbestos cement pipes or the manufacturer's equivalent with minimum load bearing factors of 2.8 and 1.9 respectively.

5.32. The following publications shall be used to establish class of bedding and class of piping for installation other than the above. They shall also serve as guide for preparation of bedding, installation and testing.

1. Installation manual of the Ontario Concrete Pipe Association.
2. Design data of the American Concrete Pipe Association as distributed by the Ontario Concrete Pipe Association.
3. Cast iron soil pipe and fittings handbook of the cast iron soil pipe institute.
4. Sewer pipe manual of Canron.
5. Sewer Design & Construction of the Water Pollution Control Federation.
6. The Blue Brute and Ring Tite PVC gravity sewer pipe installation Guide by Manville.

5.33. Pipe passing under a driveway or parking lot with less than 1.5 m (5 ft.) of cover shall be encased in 150 mm (6 in.) of 13800 kPa (2000 psi) concrete on top, bottom and sides.

5.34. Provide thrust blocks of 20 mPa (3000 psi) concrete at each tee, elbow, valve and other fitting where thrust forces could occur. Thrust blocks shall be sized to suit the local authorities requirements, but in no case be smaller than 150 mm (6 in.) greater on all sides than the pipe served.

5.35. PC4 joiting material shall not be used on underground piping. PC4 or similar jointing material shall be used for caulking waste pipes from sinks or dishwashers and other waste pipes carrying hot discharge liquids.

5.36. Connections between copper and steel pipe shall be made with brass or bronze fittings where other type of connection is not specified in regulations.

5.37. All piping shall run parallel with closest wall.

5.38. Piping in walk-in pipe spaces shall be installed as close to one wall as possible.

5.39. Each water hammer arrester shall be accessible for service and replacement. They shall be installed in compliance with the recommendations of the Plumbing and Drainage Institute as found in Standard PD1-WH201.

5.40. Slope all drains and vents in accordance with the plumbing code but not less than the minimum slopes shown on the drawings. Slope all water lines 25 mm in 12 m (1 in. in 40 ft.) unless shown otherwise.

5.41. Vent stack covers shall be properly sized for each vent penetrating the roof. Division 15 shall supply vent stack covers for installation and flashing by the roofing contractor.

6. **ROOF DRAIN**

6.1. Roof drains shall be J.R. Smith, Zurn, Mifab, Watts.

6.2. Roof drains in metal decks or poured concrete roofs shall be coated cast iron body, large sump, wide non-crimping flange, vandal proof aluminum or ductile iron mushroom dome strainer, extension frame to suit thickness of insulation, sump receiver, under-deck clamps and flashing clamp with integral gravel stop. J.R. Smith 1010-AD-E-R-C-U, Zurn ZA-100-E-C-R-VP, Mifab R1200-6-M-B-U-V, Watts RD-100-B-D-K80-L-V.

6.3. Roof drains for flooded roofs shall be as specified above but shall be complete with flooding dam to provide approximately 50 mm (2 in.) depth of flooding.

6.4. Where flow quantities for roof drains are shown, the drains shall as specified above but shall be equipped with weirs to give flow quantities shown.

6.5. Roof drains in I.R.M.A. or upside-down roofs shall be similar to drains specified above but with cast extensions to suit full depth of gravel and/or pavers and insulation and cast slotted surround for full depth of gravel and insulation for all openings larger than 12 mm (1/2 in.). J.R. Smith 1012-AD-LR-C-U, Zurn ZA-100-SE-C-R-VP, Mifab R1200-HC-6-M-B-U-V, Watts RD-100-CH-B-D-K80-L-V.

6.6. Promenade drains shown as stainless steel shall be as specified above but with adjustable ductile iron or cast iron 300 mm x 300 mm (12 in. x 12 in.) square grate with cast stainless steel veneer, all polished to No. 4 satin finish.

6.7. Provide screens as required to prevent gravel from entering the drain pipes.

6.8. Expansion compensators shall be J.R. Smith 1710, Zurn Z-190, Mifab R1900, Watts RD-900.

6.9. Turn drain bodies over to roofing and waterproofing trades on site for priming and setting into bearing pads of waterproofing materials.

6.10. Roof drains connected to vertical rain water leaders with less than 1200 mm (4 ft.) of horizontal offset shall be complete with expansion compensators.

7. **MANHOLES**

7.1. All manholes shall conform to the Ontario Provincial Standard Drawings.

7.2. Interior manhole covers and frames to be model DS-579, 600 mm (24 in.) with closed cover.

7.3. Exterior manhole covers and frames to be model DS-579, 600 mm (24 in.) with open cover.

7.4. Manholes to be precast type, minimum 1067 mm (42 in.) diameter and maximum to suit size of sewer, depth of bury and local authority requirements. Set manhole on poured in place base.

7.5. Manhole deign shall meet DTC Specification Drawing no. DD712.

7.6. Steps to be 19 mm (3/4 in.) diameter galvanized steel set at 300 mm (12 in.) centres.

7.7. Manholes in excess of 3660 mm (12 ft.) deep shall be provided with aluminum safety grating, factory set in precast section.

7.8. Manhole covers shall be Canron, or McCoy Foundry. Precast manholes shall be Oaks Precast.

7.9. Make necessary connections of pipe manhole. Provide benching in manholes using 20 Mpa (3000 psi) concrete.

7.10. Supply and install manholes in locations indicated.

7.11. Units shall be installed to inverts as shown.

7.12. Precast manhole sections shall be set on poured in place 20 Mpa (3000 psi) concrete base.

8. **PLUMBING FIXTURES**

8.1. Provide new plumbing fixtures where indicated on plans of make and model as specified. All fixtures must be first quality, best grade obtainable, cleaned and in perfect condition. Fixtures shall be piped complete with all required support and accessories, drainage, vent and water connection. Install all components in accordance with the manufacturer's recommendation for best practice.

8.2. Final location of all new plumbing fixtures shall be co-ordinated, on-site with all trades. Refer to Architectural,/Interior Design drawings and details for exact location of all plumbing fixtures.

8.3. Fixtures shall be as manufactured by American Standard, Crane or Kohler, equal to the fixtures specified. Fixtures shall be white.

8.4. Fittings and trim shall be as manufactured by American Standard, Chicago Faucets equivalent to the trim specified. All exposed valves, fittings, escutcheons, trim, etc., at each fixture shall be polished chrome plated brass unless specified otherwise.

8.5. All tanks of water closets shall be internally lined with anti-sweat insulation.

8.6. Relocate existing fixtures where shown. Dismantle, store and re-install fixtures and brass. Provide all necessary materials to complete the installation in the new location.

8.7. Water closets shown as type 'WC-1 – Floor mounted flush valve' shall be "Low Consumption", floor mounted for flush valve, vitreous china, elongated siphon jet flush action bowl, fully glazed 50 mm (2 in.) internal trap way, 280 mm x 330 mm (11 in. x 13 in.) large water surface, 6 L (1.6 gal.) flush, 38 mm (1½ in.) top spud, and bolt caps. Provide floor flange, flange bolts and gasket. American Standard Madera Elongated 2234.015, Crane Whirlton 3325, Eljer Signature 111-2125, Kohler Wellcomme Lite K-4350.Flush valve for WC unit above shall be quiet action, exposed diaphragm flush, renewable seat, polished chrome plated finish, volume control, vandal resistant cover screw, metal "non hold open" handle, 1 in. FIP/copper sweat inlet adaptor angle check stop with protecting cap, adjustable 120 mm (4¾ in.) plus or minus 11 mm (7/16 in.) inlet/valve outlet centers, vacuum breaker, 38 mm (1½ in.) dia. cover tube and wall flange, spud flange, and concealed spud nut. Delta Commercial 81T201, Sloan 111-YO-XL, Zurn Z-6000AV-WS1-YO. Seat for WC unit above shall be elongated heavy-duty solid plastic toilet seat, less cover, with stainless steel check hinge and stainless steel posts, washers and nuts; Bemis 1955-C, Centoco #500STSCC, Lustra Kohler K-4670-C, Olsonite 10CCSS.

8.8. Lavatory shown as type 'L-1' shall be, American Standard 'LUCERNE' wall-mount sink, centre hole only, 20-1/2"x 18-1/4" x 6-3/4" (521mm x 464mm x 171mm) deep, wall hung, front overflow, vitreous china, D-shaped bowl, self-draining deck area with contoured back and side splash shield. American Standard 'CERAMIX' #2000.160X.002 or Chicago Faucet Marathon #2200 Faucet, C.P. single hole C.C., solid cast brass lead-free body, washerless, ceramic drip-free disc valve cartridge, maximum temperature limit stop, with 1.84 GPM (8L) flow aerator outlet, less escutcheon plate for single hole mounting, single control metal lever handle, and 3/8" (10mm) supply tubes. McGuire #155A Drain, C.P. open grid. McGuire #H165LKN3RB Supplies, C.P., polished, short horizontal with V.P. loose key angle stops, escutcheons, less braided flexible risers. McGuire #8872C 'p' Trap, C.P. cast brass, 1-1/4" (32mm) with cleanout and escutcheon. Smith Series #0700-M Carrier, with steel pipe legs, block base feet support, concealed arms and pedestal

plate. (For narrow wall installation provide 'Z' type sleeve for arms.) American Standard #0059.020 Semi-China Pedestal to cover exposed piping as per local codes.

8.9. One compartment s.s. sink shown as type 'CS-1' shall be Kindred 'CLASSROOM SINK' #LBS-6408P-1, S.S. Sink, 1 hole, 14-1/8" x 20-13/16" x 8" (410mm x 530mm x 203mm) deep, counter mounted, grade 18-10 type 304 stainless steel, single compartment, self riming. Monterrey #7502-140 Single Supply Sink Faucet with tempering valve. rigid/swing gooseneck spout, deck mounted, Vandal Proof 2.2 GPM (8.3 L/min) Pressure Compensating Softflo Aerator, 4" Metal Wristblade Handle with Secured Blue Service Button, and 1/2" NPSM Supply Inlets with Coupling Nut for 3/8" or 1/2" Flexible Riser.

8.10. Mop sink shown as type 'MS-1' shall be Stern-Williams #MTB-2424 Mop Sink, 24" x 24" x 10" (610mm x 610mmx 254mm) deep, floor mounted, precast terrazzo and Integral Drain with strainer. Chicago Faucets #305VB-R-XK-Hose Faucet, C.P. 8" (203mm) C.C., wall mounted, solid cast brass lead-free body, 1/4 turn ceramic disc valve cartridges, spout body, cast brass lever handles, vacuum breaker, integral stops, 36" (915mm) hose and hanger. 'p' Trap 3" (75mm).

8.11. Hose bib shown as 'HB' shall be ZURNZ1315. Exposed, non-freeze wall hydrant, with bronze casing, all bronze interior parts, non-turning operating rod with free- floating compression closure valve, replaceable bronze seat and seat washer, and combination 3/4 [19J female or 1 [25J male straight IP inlet with 3/4 [19J IP 90° inlet elbow with union nut. Complete with operating key.

8.12. Provide the necessary plates, brackets, cleats, supports etc., for rigidly securing fixtures in place. All roughing in shall be accurately laid out. No offset will be accepted.

8.13. All fixtures shall be free of defects. Any fixture which, in the opinion of the Consultant, is damaged shall be removed and replaced. Clean and polish all fixtures and trim upon completion.

8.14. Wall mounted fixtures shall be installed symmetrical with wall tile pattern.

9. **SPRINKLERS**

9.1. All sprinkler work in this contract shall be performed by a Sprinkler Contractor approved by TDSB and all costs are to be included in the Tender Price.

9.2. Hydraulically design the modifications to the existing wet sprinkler system, in accordance with the existing base building design criteria, N.F.P.A. standards and the standards of any other governing body as directed by TDSB. Each system is to be complete with test and drain connections as required.

9.3. Submit hydraulic calculations as applicable and layout drawings indicating all piping valves and sprinkler heads.

9.4. Drawings to have Contractor's Company Name and P.Eng stamp. Submit to all local governing authorities for permit and the consultants for approval, and receive approvals prior to fabrication and installation.

9.5. All sprinkler work shall be to the approval of TDSB and Tenant's Insurance Underwriter and shall conform to the base building specifications and all governing authorities. The fabrication and installation must comply with the requirements of the current publication of N.F.P.A.-13.

9.6. Confirm existing system pressure, where work is to be performed, and design all components to suit, allowing a minimum 10% safety margin.

9.7. All new sprinkler work must be tested in accordance with TDSB requirements or at 200 PSI for a minimum of 2 hours. A copy of all test certificates must be submitted to TDSB and Consultant.

9.8. TDSB and/or the Consultant must be informed when all tests are to take place.

9.9. The main sprinkler shut-off valve, for the floor where sprinkler alterations are being made, must only be "closed" during normal business hours and must be returned to the open position for nights, holidays and weekends, unless special arrangements have been made with TDSB and the local Fire Department.

9.10. Adjust, reuse and add sprinklers and piping as required in accordance with the new space partitioning and ceiling layout requirements. The sprinkler head layout indicated on the drawings shows the general intent and head type, but does not necessarily indicate all of the required heads. Add heads as needed to provide full coverage.

9.11. In areas where existing ceilings are being replaced, include cost to remove and replace the sprinkler heads or escutcheon rings as required. If ceiling levels are being changed, include cost to relocate sprinkler heads to new ceiling level.

9.12. Co-ordinate sprinkler system with all trades. New hydraulically designed sprinkler piping as required to suit new sprinkler layout and to avoid interference with ductwork and equipment. Allowances for additional work and materials required to suit site conditions and re-routing of new services shall be included in the Tender Price.

9.13. Provide new semi-recessed sprinkler heads in lay-in T-bar ceilings.

9.14. Co-ordinate the location of all heads with the Consultant.

9.15. All equipment and material shall be U.L.C. approved.

1. General:

.1 All components used in the sprinkler system shall be U.L.C. listed. UL or FM listed equipment not bearing a U.L.C. listing shall only be acceptable if written approval from the local authority is obtained.

.2 All components used in the sprinkler system shall be manufactured in Canada or USA, whenever available.

9.16. Pipe, valves and fittings less than 1206 kPa (175 psi) working pressure shall be as follows:

1. Pipe, black steel, Schedule 40, A.S.T.M. A53.
2. Fittings for a minimum of 1206 kPa (175 psi) working pressure, 1035 kPa (150 psi) malleable iron ASME B16.3, 860 kPa (125 psi) cast iron ASME B16.4, butt welding schedule 40 ASME B16.25, or roll grooved Victaulic, Gruvlok or Tyco.
3. Dry pipe and fittings for all F.M. projects shall be galvanized.
4. All valves shall be U.L.C. listed.
5. Gate valves 50 mm (2 in.) and smaller, all bronze O.S. & Y screwed, 1207 kPa (175 psi) working pressure. Crane No. 459.
6. Ball valves 50 mm (2 in.) and smaller may be used as an alternative to specified gate valves, bronze body, chrome plated brass ball, stainless steel stem, TFE seat. Victaulic Series 728 Firelock.
7. Butterfly valves 50 mm (2 in.) and smaller may be used as an alternative to specified gate valves, bronze body, screwed ends, stainless steel disc and stem. Milwaukee Valve BB-SCS02.
8. Gate valves 65 mm (2-1/2 in.) and larger iron body bronze mounted, O.S. and Y flanged or grooved ends. Crane No. 467.
9. Butterfly valves 65 mm (2-1/2 in.) and larger may be used as an alternative to specified gate valves, threaded lug type body, ductile iron body, stainless steel stem, gear operator, 1207 kPa (175 psi) working pressure.
10. Butterfly valves 65 mm (2-1/2 in.) and larger grooved ends may be used as an alternative to specified gate valves, ductile iron body, stainless steel stem, gear operator, 1207 kPa (175 psi) working pressure. Victaulic Series 705 W Firelock, Gruvlok GN7722-3D, or Tyco BFV-1.
11. Check valves 50 mm (2 in.) and smaller, all bronze replaceable seat, screwed ends. Crane No. 137.
12. Check valves 65 mm (2-1/2 in.) and larger iron body, bronze mounted, flanged or grooved ends. Crane No. 375, Victaulic Series 717 Firelock, Gruvlok 78FP or Tyco CV-1F.
13. All grooved products including couplings, fittings and valves shall be of one manufacturer.
14. Fittings with grooved connections at all legs of the fitting or couplings, shall be equal to Victaulic 920, Tyco/Central Figure 730, or Gruvlok Figure 7045 Clamp-T will be accepted. Fittings and couplings that are not acceptable are ones equal to Victaulic 921, Tyco/Central Sprinkler Strap 40-5, or Gruvlok Figure 7045 U-bolt.

9.17. Alternative pipe downstream of alarm check valve, (galvanized) Schedule 10 to ASTM-A795 minimum roll grooved ends for 1200 kPa (175 psi) working pressure. Refer to Bid Form and provide alternate price.

9.18. No grooved fittings or products shall be used except for those specified. All grooved products shall be of one manufacturer.

9.19. Pipe valves and fittings over 1206 kPa (175 psi) working pressure shall be as follows:

1. Pipe, black steel, schedule 40, A.S.T.M. A53 (up to 2070 kPa (300 psi)).
2. Fittings, 2070 kPa (300 psi) malleable iron ASME B16.3, 1720 kPa (250 psi) cast iron ASME B16.4, or butt welding schedule 40 ASME B16.25.
3. Dry pipe and fittings for all F.M. projects shall be galvanized.
4. Gate valves 50 mm (2 in.) and smaller all bronze, rising stem, screwed Class 200, Crane No. 459 U.L. listed and to local authorities approval.
5. Ball valves 50 mm (2 in.) and smaller may be used as an alternative to specified gate valves, bronze body, chrome plated brass ball, stainless steel stem, TFE seat. Equal to Victaulic Series 728 Firelock,
6. Gate valves 65 mm (2-1/2 in.) and larger, steel body, flanged or welded, Exalloy stellite trim, O.S. & Y equal to Class 1930 kPa (150 to 280 psi) Crane No. 47XUF or Kitz 150SCL and Class 300 above 1930 kPa (280 psi) Crane No. 33XUF or Kitz 300 SCL, and to local authorities approval.
7. Check valves 50 mm (2 in.) and smaller all bronze, swing check, class 200, to local authorities approval.
8. Check valves 65 mm (2-1/2 in.) and larger, steel body, flanged or welded Exalloy trim, equal to Class 1930 kPa (150 to 280 psi) Crane 147X or Kitz 150SCO, and Class 300 above 1930 kPa (280 psi) Crane 159X or Kitz 300SCO, and to local authorities approval.
9. Express riser shall be welded pipe and fittings.

9.20. Alternative pipe downstream of alarm check valve, (galvanized) Schedule 10 to ASTM-A795 minimum roll grooved ends for up to 2070 kPa (300 psi) working pressure. Refer to bid form and provide alternate price.

9.21. Combination test and drain valve 50 mm (2 in.) inlet, 50 mm (2 in.) outlet, sprinkler test orifice and sight glass. This valve may be used in lieu of separate 50 mm (2 in.) drain valve, 25 mm (1 in.) test valve, sprinkler test orifice and sight glass. Victaulic 720 TestMaster II.

9.22. Sight glasses shall be 1207 kPa (175 psi) working pressure.

9.23. Hangers, hanger rods and inserts in all parking and ramp areas shall meet the requirements of CAN/CSA-S413-94 and shall be of corrosion resistant material or shall have an effective, durable, corrosion resistant coating.

9.24. Provide approved type backflow prevention complete with supervised valves, on glycol loops.

9.25. The pressure reducing valves on the sprinkler down-feed riser shall be hydraulically operated globe valve with U.L.C. label rated at 1206 kPa (175 psi) working pressure. Valves to be sized for maximum 69 kPa (10 psi) pressure drop at 31.5 L/s (500 USGPM) flowing. Singer 106-PR-8702 or Cla-val 90G-21.

9.26. Pressure reducing valve stations shall consist of two valves each sized for 100% flow in parallel each with supervised isolating valves to permit servicing. All isolating valves on sprinkler system shall be located not higher than 1828 mm (72 in.) above the floor.

9.27. Alarm flow switches shall be U.L.C. approved and equal to Potter VSR-F. Wiring to annunciator panel shall be by the Electrical Division – Division 16.

9.28. Switches for supervised valves shall indicate a trouble when valve not fully open. Switch shall be complete with contacts for alarm and supervision. All wiring to annunciator panel shall be by the Electrical Division – Division 16. Plug in type switches are not acceptable. Switches shall be equal to Potter OSYSU.

9.29. Alarm check valve shall be complete with all appurtenances including contacts for wiring to the building fire alarm system for low pressure and flow, water gong mounted where shown or directed, electric alarm bell mounted where shown or directed, and all valve, gauges, fittings and drains. Victaulic Series 751 Firelock, Tyco AV-1-175/AV-1-300, or Viking Model J-1.

9.30. Connection between fire protection system and the domestic water system shall have a double check valve assembly conforming to CSA B 64.5 and with U.L.C. listing and components. For all systems that have chemical treatment or other substances added that contaminate the water the connection between the fire protection system and the domestic water system shall have backflow preventer assembly conforming to CSA B 64.4 and with U.L.C. listing and components. All valves shall be supervised, and shall be of one of the manufacturers listed under the Pipes, Valves and Fittings Section

10. **DUCTWORK, FITTINGS AND EQUIPMENT**

10.1. All ductwork construction, support and installation shall be in accordance with the latest A.S.H.R.A.E. and S.M.A.C.N.A. recommendations and the base building standards.

10.2. Flexible ducts shall be spiral aluminium Flexmaster Triple Lock Model #T/L installed as one continuous piece. Joining of flexible ducts is not permitted. Maximum length shall not exceed 10 ft.-0 in. (2500 mm). Connect to ductwork with duct sealer IN the joints and with screws. Duct tape is not acceptable. Size of flexible ducts shall be equal to the diffuser neck size. Ducting shall conform to NFPA 80A and UL181.

10.3. Provide duct sealer on all new duct joints.

10.4. Duct sealer to be equal to PROseal and FIBERseal, to be applied with brush or flow gun. Duct sealer shall be non-V.O.C., permanently flexible, low shrinkage, and ULC classified for surface burning characteristics. Application to be made when air system(s) are off, to allow material to cure 24-72 hours before pressure test the system. Where ducts are exposed, all joints are to be wiped clean of any excess sealer. Where ducts are externally insulated, sealer must be 100% air tight, to avoid blowing off the insulation. Since field temperature/humidity conditions may vary, longer set times may required for specific installations. Apply at a rate of 50 sq.ft. per gallon (1/32" thick).

10.5. Rigid round ducts shall be of spiral construction. Dampers with Duro-Dyne or equal 1/4 in. dial regulator set and bearings are required at all round duct branch take-offs. See standard detail for requirements.

10.6. Provide duct access doors with sash locks at both sides of fire dampers, smoke dampers, control dampers, coils and as required for servicing for any other device. Size to be minimum 16 in. x 12 in. (400 mm x 300 mm).

10.7. Provide flexible connections between all fans and adjacent ductwork with a minimum 6 in. (150 mm) separation between fan and ductwork. Flexible connections shall consist of a preassembled unit of fire resistant P.V.C. weave equal to Duro Dyne Canflex.

10.8. Provide 1 in. (25 mm) flexible scrim faced acoustic insulation equal to "Knauf" duct liner "M" for supply, return or exhaust ductwork where indicated. All dimensions on drawings are clear inside dimensions. Where acoustic insulation is installed, increase dimensions accordingly. Lining to be attached with complete coverage of adhesive and pins on maximum 18 in. centres. All raw edges of lining to be buttered down with duct sealer or metal edges to avoid erosion of fibres. Spray adhesive is not acceptable.

10.9. Provide balancing dampers for all new duct branches. Provide also balancing dampers and splitter dampers in all new ductwork as requested by the air balancing company.

10.10. Provide fire dampers where shown on drawing and where required by local authorities and applicable codes.

10.11. Fire dampers shall be type 'B', with blades outside the air stream, U.L.C. labelled, fabricated and installed to the approval of all authorities having jurisdiction. Install fire dampers in sleeves, secured with angle supports in accordance with NFPA 90A and CUA 90-1.

10.12. Relocate and reuse existing diffusers, and grilles as indicated on plans. Reuse existing removed ductwork wherever possible and where conditions permit.

10.13. Where transfer air openings in drywall walls are noted on the drawings, the mechanical contractor is responsible to provide the layout. This contractor shall co-ordinate and verify that the required number and size of openings have been provided.

11. **DIFFUSERS, GRILLES AND REGISTERS**

11.1. All diffusers, grilles and registers shall be manufactured by Price, Titus, Nailor, Krueger or Carnes equal to the units specified

11.2. All diffusers and registers to be complete with volume dampers. All volume and air pattern devices shall be fully adjustable from the face of the diffuser, register or grille.

11.3. Noise generated by diffusers shall be such that room sound pressure level does not exceed noise criteria 30 with an 8 db room attenuation, the sound power level reference to 10 to –12 power watts.

11.4. Relocate and reuse existing diffusers and grilles as indicated on plans.

11.5. All diffusers shown as type “A” shall linear supply diffusers of the sizes, configurations and mounting types required. Diffusers shall have 1 discharge slot 12.5 mm wide with extruded aluminum aerodynamically curved pattern controller for 180 degree air pattern control and airflow dampening if required. The diffuser border shall be heavy extruded aluminum construction with extruded aluminum spacers and mitered end flanges. Frame shall be recessed into plaster or gypsum board with no mounting flange visible. All diffusers shall have a removable concealed fixing device. Colour shall match architectural ceiling and diffuser face shall be pre-coated with a lacquer protective. Continuous length units shall be provided with factory assembled corner modules to suit drawings and on site conditions. Joiner strips shall be provided to align continuous slot assemblies. E.H. Price SDS/SDA, Nailor Series 5000/5300, Krueger 1900, Carnes CHDB.

11.6. Linear ceiling diffusers shown as type “B” shall be 1 slot, 25 mm diffuser modified with square ends to limit side spread, and of 48 in. lengths, as shown. Diffuser shall be installed with manufacturer plenum to match the length of the diffuser shown, with mounting clips to suit continuous T-bar or ceiling openings. Pattern controllers shall be split mid length to allow each half of diffuser to be set for different throw patterns. Throw patterns shall be fully adjustable from vertical to horizontal and variations in between. Provide ‘Z’ baffle blank-off panels between ceiling diffusers and within inactive sections of ceiling slot openings (co-ordinate with Architectural drawings). Pattern controllers and blank-off panels shall be finished in matte black. Plenum shall be fabricated from coated steel. Refer to Architectural Details for installation of continuous supply air slot. EH-Price TBD3 series, Nailor 5800, Krueger PTBA, Carnes DASC.

11.7. Return registers shown as type “C” shall be standard return grilles with horizontal fixed bars set at approximately 45 deg. for wall returns and set straight for ceiling return. Key operated damper shall be mounted behind. E.H. Price 530, Nailor 6100 Series, Krueger S80, Carnes model RSBAH.

11.8. Square diffusers shown as type “D” shall be square steel plaque 600 mm x 600 mm (24 in. x 24 in.) face size and shall be square, coned metal. Diffusers shall consist of a precision formed back cone of one piece seamless construction which shall incorporate a round (or square) inlet collar of sufficient length for connecting rigid or flexible duct as shown. An inner plaque assembly shall be incorporated that drops no more than 1/4" below the ceiling plane to assure proper air distribution performance. The inner plaque assembly shall be completely removable from the diffuser face to allow full access to any dampers or other ductwork components located near the diffuser neck. E.H. Price SPD, Nailor UNI, Krueger PLQ, Carnes SFPA.

11.9. Return grilles shown as type “E” shall be sized as shown on drawing and shall be egg crate type with aluminum construction. Egg crate shall be 12 mm (1/2 in.) deep, formed of 12 mm (1/2 in.) wide aluminum strips on 12 mm (1/2 in.) centres. Strips shall be approximately 0.64 mm (0.025 in.) thick. Grilles shall be enclosed in a channel frame for T-bar mounting or in a flanged frame for plaster or gypsum ceiling mounting. Grilles shall lay on inverted T-bar ceiling suspension system. Colour shall match adjacent ceiling tiles. E.H. Price Series 80, Nailor 5100 Series, Krueger EGC5 Series, Carnes RAPAH.

11.10. All diffusers shown as type “F” shall linear return diffuser of the sizes, configurations and mounting types required. Diffuser shall have 2 discharge slot 25 mm wide with extruded aluminum aerodynamically curved pattern controller for 180 degree air pattern control and airflow dampening if required. The diffuser border shall be heavy extruded aluminum construction with extruded aluminum spacers and mitered end flanges. Frame shall be recessed into plaster or gypsum board with no mounting flange visible. All diffusers shall have a removable concealed fixing device. Colour shall match architectural wall and diffuser face shall be pre-coated with a lacquer protective. Continuous length units shall be provided with factory assembled corner modules to suit drawings and on site conditions. Joiner strips shall be provided to align continuous slot assemblies. E.H. Price SDR.

11.11. Colour of diffusers shall match colour of ceiling tile in lay-in ceilings. Diffusers to suit ceiling grid as required imperial or metric.

11.12. Where diffusers or grilles are provided in t-bar ceilings, provide lay-in type, and where located in drywall provide surface mounted. Review ceiling types with the Designer’s reflected ceiling plan prior to ordering these items.

11.13. Where rigid duct is connected to the diffuser, grille or register all devices used for flow pattern adjustment and flow balancing shall be accessible from the face of the diffuser.

11.14. Refer to the architectural drawings for actual locations of diffusers, grilles and registers and install to suit these drawings. The mechanical drawings show intent and number of diffusers, grilles and registers required.

12. **ROOF MOUNTED EXHAUST FAN**

12.1. Roof exhaust shall be Penn, Greenheck or Loren-Cook. All roof exhaust fans shall be AMCA rated for air and sound and shall be C.S.A. approved and labelled.

12.2. Fan shall be mounted in a square or rectangular roof hood assembly which shall have mounting pedestal to fit on a roof curb.

12.3. The hood shall be attached with non-ferrous bolts and nuts and shall be readily removable.

12.4. Dome type exhausters shall be spun aluminium with rolled edges. All exposed parts shall be heavy gauge marine aluminium 3003 and treated to reduce corrosion.

12.5. Fans shall be backward inclined, non-overloading sealed bearings rated at 200,000 hours. Drives shall be adjustable to 7.5 HP (5.6 kW).

12.6. Motors and drives shall be enclosed in a weatherproof compartment, separately ventilated from the exhaust air stream.

12.7. Unit shall be complete with a non-corrosive bird screen, gravity damper with Neoprene edges and weather proof disconnect switch.

12.8. Unit shall be mounted on a prefabricated roof curb to match the fan size. Curb shall be flat for flat roofs and pitched to suit slope of roof for sloped roofs. All curbs shall be acoustically lined. Unit shall be nominally 12" (300mm) high.

12.9. Roof exhaust fans shall be as follows:

EF-1.1 - Greenheck Model No.065-G, 100 CFM, 0.2 e.s.p. and 1/60 h.p. motor.

13. **ROOF MOUNTED UNIT**

13.1. Standards

1. All unit(s) shall include CSA (Canadian Standards Association) design certification for use in both the US and Canada to the ANSI Z83.8 - latest revision, standard for "Gas Unit Heater and Gas-Fired Duct Furnaces" for safe operation, construction, and performance.

2. ETL certified duct furnace, blower, cooling, and downturn sections to UL 1995/CSA C22.2 No. 236 "Heating and Cooling Equipment" and UL 795 "Commercial - Industrial Gas Heating Equipment" for electrical and mechanical safety.

13.2. Mechanical Configuration

1. All unit(s) shall have right side (opt left side), when looking into the discharge, access to all controls and include:

2. Furnace section(s) with 80% minimum efficiency provided by an indirect-fired heat exchanger with dimpled tube pattern for efficient heat transfer.

3. Blower section containing a supply blower and motor with bottom support to provide rigidity. The blower connection shall be flexible with ¼" gasket to prevent sound transmission into the supply ductwork.

4. Electrical section isolated from the supply air stream including a hinged access door. Separate knock-outs shall be provided for both high and low voltage electrical connections. Provisions must be included for side access electrical connections for slab mounted units and bottom electrical connections for roof curb mounted units.

5. Downturn plenum section for downward deflection of the supply air.

6. Rainhood and birdscreen shall be pre-assembled from the factory and provided with internal baffles to prevent water entrainment in the supply air stream.

7. Roof curb with wood nailing strips and assembly hardware. The roof curb members shall be 16" high to meet the National Roofing Contractors Association requirements and constructed from 16 gauge aluminized steel.

8. The curb shall include insulation.

13.3. Venting Arrangement

9. The venting shall be a gravity vented arrangement with a combination combustion air / exhaust vent cap that minimizes the pressure differential between the inlet and exhaust of the venting system. This pressure differential shall reduce the burner flame disturbance to insure proper ignition when the unit is subjected to 40 mile per hour wind velocities. The cap shall prevent rain from entering the unit through the use of combustion air inlet louvers at a minimum of 6 inches from the unit roof.

13.4. Unit Casing

10. The unit casing shall be constructed of not less than 18 gauge aluminized steel.

11. All exterior casing parts shall be painted with a baked-on gray-green polyester powder paint (7 mil thickness) for corrosion resistance.

12. All access side doors shall have heavy duty, draw tight, quarter turn latches.

13. Blower, cooling, and downturn sections when provided shall include 1 inch, 1½ lb density acoustical and thermal insulation. The insulation shall be made of glass fibers bonded with a thermosetting resin and overlaid with a fire-resistant black acrylic coating for additional strength. The acrylic coating must meet the requirements of ASTM C 665 for fungi resistance.

13.5. Furnace Section

14. The heat exchanger shall be made of 20 gauge 409 stainless steel tubes and headers. The thermal efficiency of the unit shall be a minimum of 80% efficient for all air flow ranges.

15. The restrictor shall be sized to maintain the unit efficiency of 80% in the temperature range of 20℉-100℉.

16. Each heat exchanger tube shall be individually and directly flame-fired. The heat exchanger tube shall be contoured and dimpled to provide efficient heat transfer and crimped to allow for thermal expansion and contraction. The flue collector box shall be made of 20 gauge aluminized steel.

17. The heat exchanger(s) seams and duct connections shall be certified to withstand 3.0” W.C. external static pressure without burner flame disturbance.

18. The burner(s) shall be made of the same material as the heat exchanger with a thickness of not less than 28 gauge. Burner(s) shall have non-clogging, slotted ports with a stainless steel separator strip designed for good lighting characteristics without noise of extinction for both natural and propane gas. The burner(s) shall be located for service removal without disconnecting the main gas supply piping.

19. The bottom of the unit shall be angled for draining any condensation to the corners of the unit. The condensation shall be removed through openings in the bottom pan. The drain pan shall be constructed of 20 gauge aluminized steel.

20. The gas manifold(s) piping shall allow for gas piping connection on the side of the unit for slab mounted units and through the unit bottom for roof curb mounted units. The manifold(s) shall include a ground joint union for ease of servicing of the orifices without removing the burner assembly or main gas valve string.

21. The orifices shall be provided on both natural and propane gas with adjustable air shutters for controlling the primary air mixture.

22. The ignition controller(s) shall be 100% shut-off with continuous retry for natural gas.

23. The gas pressure shall be between 6-7” W.C for natural gas.

24. The solid state ignition system shall intermittently light the pilot each time the system is energized. Once the pilot is proven, the main gas valve shall open and allow gas flow to the main burner.

25. The unit gas controls shall be provided with the following:

26. Electronic modulation gas controls with an electronic modulating/regulating gas control, combination gas valve, an ignition control, modulating amplifier, and a modulating duct thermostat with remote temperature set point adjuster. The thermostat can modulate the system gas flow between 40% through 100% full fire. The firing rate shall be controlled by a duct sensor with remote temperature adjuster.

27. A 1/8" manifold pressure tap shall be located after all valves to test the manifold pressure directly before the main burner orifices.

28. The unit shall be provided with a single gas control transformer to step down the supply voltage to 24V.

29. Separate line voltage and low voltage terminal strips shall be provided to prevent the unit from being miswired.

30. Automatic reset high limit switch.

13.6. Provide the following factory installed options:

31. Air flow proving which shall be an adjustable differential pressure switch to insure air flow across the heat exchanger before allowing the gas controls to be energized.

32. A timed freeze protection discharge air thermostat used to prevent building freeze up in the event of a burner failure. The timer shall be adjustable from 1 to 5 minutes.

33. A time delay relay which delays the start of the blower to allow the heat exchanger a warm-up period after a call for heat. The time delay relay shall also continue the blower operation after the thermostat has been satisfied to remove any residual heat on the heat exchanger.

34. The unit shall be orificed for up to 2000 feet elevation above sea level.

13.7. Electrical Section

35. All electrical components shall carry ETL, or CSA listing.

36. The unit shall be supplied with a disconnect switch to disconnect power to the unit for servicing. The disconnect switch style shall be field installed non-fusible box type.

37. A single step down transformer shall be provided for all unit controls.

13.8. Blower Section

38. The blower motor shall meet the following requirements.

39. The blower motor type shall be:

40. Single-speed, totally enclosed (TE).

41. The motor shall be rated for: 208-230V/60Hz/3Ph.

42. The motor horsepower shall be 1.

43. The unit shall contain a single supply blower that is supported from the bottom to prevent the blower flanges supporting the weight of the motor. The blower shall be a double width, double inlet (DWDI) forward curved, belt driven, assembly with spider ball bearings.

44. The unit shall be provided with a filter rack with 2" Farr Aeropleat® III filters. The Aeropleat III has a rating of MERV 7 when evaluated per ASHRAE Standard 52.2-2007.

45. Dampers and Damper Controllers

46. All fresh air dampers are ultra low leak, Class II leakage resistance (less than 10 CFM/ft^2 at 1" W.C.) dampers with self-compensating stainless steel side seals and santoprene and galvanized steel blade seals. All return air dampers, which are used for air balancing, shall be low leak, Class III leakage resistance (less than 40 CFM/ft^2 at 1" W.C.) dampers with self-compensating stainless steel side seals and santoprene blade seals.

47. The damper actuator shall be mounted directly to the shaft of the fresh air damper. If return air dampers are provided, a damper linkage rod shall be provided to set the positions of the opposed dampers.

48. The damper actuator shall be spring return so when power is disconnected, the damper closes the outside air opening.

49. Air Control DA = The unit shall be provided with fresh air dampers with a two-position damper motor with no return air or modulating control for free air cooling purposes.

50. A mild temperature thermostat used to automatically lock out the gas controls when the outdoor temperature reaches the desired set point.

13.9. Mounting Base

51. The unit shall be provided with a 14 gauge, galvanized steel, combination curb and slab type mounting base with lifting and anchoring holes.

13.10. Heat Pipe

1. Coil tubes shall be oriented vertical and the fins run horizontal. Each row shall be have one liquid line at bottom and one gas line at top and constitute one circuit. Lines shall be sized according to the performance requirements of the circuit. Each heat pipe section shall be installed level and connected to the other section by two horizontal copper lines, for each circuit, one for liquid and one for vapor in a counter flow configuration.

2. The tubes shall be copper only, of specific design for Heat Pipe application, permanently expanded onto the fin collar to form a firm, rigid, and complete pressure contact at all operating conditions. Aluminum tubes will not be allowed.

3. The fin surface shall be continuous plate type aluminum fins of specific design to produce maximum heat transfer efficiency for Heat Pipe applications. Airside

pressure loss shall be as given on the schedule, or otherwise specified. Fin density and the number of rows of tubes shall be as specified.

4. Heat transfer fluid shall be classified as Safety Group A1 in ASHRAE Standard 34-2010.

5. Extended drain pan(s) to be installed under exhaust coil sections.

13.11. Heat Pipe interconnecting piping and circuitry shall be as specified by Heat Pipe Technology design. Each circuit shall be individually processed, charged, hermetically sealed, and tested in the field by the manufacturer.

14. **CONDENSING BOILERS**

14.1. Boilers shall be Buderus, Viessmann or DeDietrich. Boilers shall be forced draft, natural gas fired, condensing type, having a minimum thermal efficiency of 92%, with a return water temperature of 27 deg. C., (80 deg. F.), at 100% output.

14.2. Boilers shall be A.S.M.E. rated, suitable for a maximum 60 psi (130 kPa) working pressure at 160 deg. F. and complete with the following:

1. Heat exchanger shall be 316 Stainless Steel or Cast Aluminum Alloy
2. High temperature limit control set at 72 deg. C. (160 deg. F.)
3. Fully modulating flame control
4. Positive pressure vent discharge
5. Thermometers
6. Pressure gauge
7. Burner for operation on natural gas up to 3.5 kPa (14 in. WG) supply to gas train
8. A.S.M.E. safety relief valve
9. Gas pressure regulator
10. Flame monitoring system shall incorporate CSA/UL combustion safeguard
11. 100% independent shut-off pilot control
12. Manual gas shut-off valve
13. Electric type low water fuel cut-off and test and manual reset in accordance with ASME Section IV and CSE-1 requirements. Low water fuel cut-out shall be suitable for lowest flow available to boiler with a consistent repeatability.
14. Pre-wired control panel interconnected to all controls and wired to terminal strip
15. Stainless Steel or baked enamelled jacket
16. Neutralization kit supplied by manufacturer

14.3. Boilers shall each be rated at minimum 100.0 Mbh input.

14.4. Boilers shall each be capable of variable flow.

14.5. Boilers shall be completely jacketed and insulated as a packaged unit, designed for minimal radiant and standby losses. Complete boiler casing and insulation shall be easily removable for inspection of the heat exchanger.

14.6. Burner shall be full modulation, low NOx, natural gas burner. NOx emissions shall be less than 20ppm.

14.7. Boiler shall be equipped with automatic temperature controller and shall be capable of continuously supplying hot water in order to achieve set point temperature. Outlet temperature should be continuously monitored.

14.8. Boilers shall be started and stopped, cycled, and sequenced for efficiency optimization by the boiler control panel.

14.9. Boiler control panel shall be based on open system communication protocol either BACnet as defined by ANSI/ASHRAE standard 135-2001 or LONWorks as defined by ANSI/CEA standard 709.1 for seamless integration with Section 15900 – BUILDING AUTOMATION SYSTEM (BAS). Boiler manufacturer to provide any necessary conversion utilities.

14.10. As a minimum, the following hardware points shall be available for direct connection BUILDING AUTOMATION SYSTEM (BAS):

1. Boiler Enable
2. Hot Water Supply Temperature Set-Point
3. Boiler supply temperature at outlet
4. Boiler status
5. Boiler output firing rate
6. Boiler General Alarm

14.11. The system is variable flow primary, when a boiler is not in use it shall be isolated from the system by way of an automatic valve supplied on the return to the boiler by this Section. The automatic valve shall open and prove flow prior to the boiler's operation. For manufacturers that can not accommodate variable flow, provide a boiler circulation pump for primary/secondary flow. All pumps and piping changes as a result shall be included in the cost of the installation.

14.12. All gas equipment shall be installed to and meet the requirements of the Ontario Department of Energy and Resources Management and be labelled accordingly.

14.13. Pipe condensate trap to closest floor drain complete with inline neutralization kit. Each boiler to have separate drain piping.

14.14. At time of start-up the manufacturer shall check the efficiency, instruct the Owner and provide a written report to the Consultant detailing all work undertaken. The manufacturer's representative shall instruct the Owner's operators on the care, operation and maintenance of the units. Final report shall include output from the gas analyzer which shall identify values for efficiency, related inlet and outlet temperatures, percentage of effluent contents, etc.

15. **CENTRIFUGAL PUMPS**

15.1. Centrifugal pumps shall be Armstrong, Leitch, or Bell and Gosset, single suction, as shown and suitable for glycol.

15.2. Pumps shall be motor mounted centrifugal type with end suction. Casing shall be cast iron, impeller shall be bronze. Impeller shall not exceed 85 percent of casing cut water point.

15.3. Motor must comply with item 1.25 of this specification.

15.4. Volute shall be split type centre line discharge and back pull out. Pump shall be bronze fitted mechanical seal shall be self lubricating. Pump to be suitable for 175 psig working pressure.

15.5. Pump volute shall be sized for a maximum of 17 F.P.S. velocity. When pumps cannot meet this requirement the manufacturer shall clearly indicate this on the shop drawing and include a written explanation as to why the particular pump has been selected.

15.6. Provide a duplex pump package complete with the following: Steel support frame, spring isolation, controls as described below and all accessories.

15.7. Provide a control panel completely factory wired to meet CSA codes, etc. The panel shall include the following plus any additional ancillaries required to provide a complete functioning system.

NEMA general purpose enclosure.

Main fused disconnect switch for each pump.

Full voltage across the line magnetic starters with 3 overloads and H.O.A. switch.

Alternator with automatic start up of stand by pump on lead pump failure.

Lead pump selector switch.

15.8. Alarm contacts for pump failure control transformer.

15.9. Pilot lights for:

power on
power running
alarm

15.10. Supply and install a flow switch in the common glycol supply pipe and wire to the alternator and the alarm.

15.11. Provide a remote alarm, 3 pump pilot lights and lead pump selector switch in the Computer Room in addition to on the control panel door.

15.12. P-1 shall by Armstrong S series S-46, Bronze construction, 75mm dia. Flange, 1/3 HP, 3 GPM @ 20 feet of head.

15.13. P-2 shall by Armstrong E series E11, Bronze construction, 75mm dia. Flange, 1/3 HP, 3 GPM @ 20 feet of head.

15.14. P-3 shall by Armstrong E series E11, Bronze construction, 75mm dia. Flange, 1/3 HP, 3 GPM @ 20 feet of head.

15.15. Increasers and reducers on pump suction and discharge shall be eccentric fittings and shall be a gradual increase or reduction to prevent unnecessary turbulence or noise.

16. **EXPANSION TANK**

16.1. Expansion tank ET-1 shall be Armstrong Model: AX-15 or equal, expansion Tank Volume: 30 litre Max. Working Pressure: 8.6 bar. Tank to complete and installed with automatic air vent Model Number: AVA – 050 and air removal trap model Number: ART-446-2 (Armstrong).

16.2. System fill shall be as part of expansion tank assembly.

17. **SPECIAL UNIT ENCLOSURES**

17.1. Shop Drawings: Submit Shop Drawings of special unit enclosures, including unit sizes, connections, and construction details. Shop Drawing shall clearly show amount of expansion on each section and method of control.

17.2. Perimeter Radiation Enclosures: shall be Engineered Air, Trane, Dunham-Bush, Rosemex, Sigma, Rittling, or Sterling as described below and detailed on Drawings.

17.3. Suitably reinforce enclosures to withstand a loading of 223 kg/lin.m (150 lbs/lin.ft.). Minimum gauges shall be as shown, but not less than 1.5189 mm thick (0.0598 in. – 16 MSG).

17.4. The enclosure shall be continuous between columns, with none permitted between the column and the enclosure. The linear discharge grille (punched grille) shall extend from column to column except for a space for partitioning centred on window mullions. Provide sound barrier partition in enclosure at each column.

17.5. Accurately form mitres, joints and other connections for a true, square and tight fit. Reinforce all corner joints with additional angle brackets so that no holes or imperfections appear after grinding. Fill all holes and remove all burrs or welds that could mar the finished surface.

17.6. Supply enclosure with electrostatically applied baked epoxy prime coat in grey. Finish enclosure before painting so that no spot welding, burrs and/or brake markings show.

17.7. Site measure for each section before fabrication and installation to ensure a correct fit of all components.

17.8. Provide supporting frame to rigidly secure the unit to the wall assembly. Support the top edge from the clip provided with the window mullion (support the top from a clip supplied with the unit and secured to the window mullion). Do not perforate the vapour barrier.

17.9. Contractor to allow for installation of a mock-up unit for Consultant and TDSB review prior to fabrication of complete system. This mock-up shall be modified as required and directed by the Consultant at no extra cost to the Owner. Final review of general arrangement for both enclosure and hook-up connection shall be obtained before manufacturing the final enclosure.

17.10. Wall fin shall be complete with:

1. Convector elements consisting of 40, 108 mm x 108 mm (4¼ in. x 4¼ in.) aluminum fins per foot on 32 mm (1-1/4 in.) copper tubes, one or two tiers high, as required to obtain capacities shown.

2. Common element and enclosure hangers with elements supported on rollers to allow for expansion.

3. Cabinets shall be as specified under Special Unit Enclosures.

4. Manually operated air vent, accessible through access door.

5. 19 mm (3/4 in.) tube and element shall be supported on maximum 1220 mm (48 in.) centres.

6. Coordinate element support with the special unit enclosures.

17.11. Wall fin convectors shall have capacity shown when supplied with water entering at 160 deg. F. leaving at 120 deg. F. and with air entering at 18.3 deg. C. (65 deg. F.).

17.12. Install fin elements so that every section of the perimeter wall is covered by finned element. Take special care in locating control valves and other such equipment to ensure that the maximum fin element length is obtained. Following review and acceptance of wall fin convector mock-up, commence installation of entire system; match quality of accepted mock-up for balance of Work.

18. **PANEL RADIATORS**

18.1. Panel Radiators shall be Rittling or Runtal.

18.2. Panel radiators shall be complete with the following:

1. Type “B” radiation shall be 4 panels high equal to Runtal Thermotouch model TT-4.
2. Steel double panel radiators of the lengths and in locations as indicated, and of capacities, style and having accessories as scheduled. The double heating panel radiation shall be of one-piece all-welded steel construction, consisting of a pair of flattened water tube panels welded to headers at each end. Welded to the inside of each panel shall be steel corrugated fins to increase the convective output of the radiator. The fins shall start at no less than 3” from the end of the radiator, and shall have no less than 32 fins per foot. The radiators shall include an integral heavy gauge (0.09” minimum) all-welded perforated top grille, which will cover the top of all of the finned areas
3. The headers shall include all necessary inlet, outlet and vent connections as required. Standard connection sizes are ½” NPT tapered thread for supply and return piping, and 1/8” for the vent connection. Internal baffling is provided where required for proper water flow
4. The radiant heating panels shall be available in lengths from 2’-0” to 29’-6” in two inch even increments without the need for splicing. The panel radiation shall be capable of being mounted to typical stud wall construction without additional blocking or strapping. Appropriate wall mounting brackets shall be provided with the radiation.
5. Wall mounting brackets shall be used for wall mounted units and pedestal mounts for floor mounted units. Refer to drawings for locations
6. Panel radiation expansion shall not exceed 1/64” per foot of radiation at 215ºF. The installer shall provide adequate expansion compensation for each radiator
7. The panel radiation shall be cleaned and phosphatized in preparation for the powder coat finish. The radiation is then finish painted with a gloss powder coat finish, for a total paint thickness of 2-3 mils (0.002” - 0.003”). The color shall be selected form the Runtal’s standard colors, or optional colors shall be available at and additional cost.

18.3. Expansion couplings shall be slant Fin Hydro – Tite or Amtrol.

18.4. Install elements so that every section of the perimeter wall is covered. Take special care in locating control valves and other such equipment to ensure that the maximum element length is obtained.

18.5. Shop Drawings: Submit Shop Drawings of wall fin convectors, including unit capacities, sizes, piping, connections, and construction details. Shop Drawing shall clearly show amount of expansion on each section, and method of control.

19. **UNIT HEATER**

19.1. Unit Heaters shall be Trane, Dunham-Bush, Engineered Air, Sigma, Rittling, or Sterling for horizontal or downward air discharge as shown.

19.2. Each unit heater shall be complete with:

1. Direct driven propeller fan and motor.
2. Heating coil with copper tubes and aluminum fins
3. Adjustable air outlet diffuser or adjustable louvre cone diffuser.
4. Enamel finish prime coated.
5. Manual starter on unit

19.3. Wall thermostat, Honeywell, Power, Johnson, Penn or White Rodgers with range 4.4 deg. C. to 26.7 deg. C. (40 deg. F. to 80 deg. F.). Thermostat shall cycle fan.

19.4. Thermostat and controls are specified under the Building Automation System Section.

19.5. Unit heaters shall have capacities as shown in the Unit Heater Schedule.

19.6. Install in accordance with manufacturer's current installation guidelines.

20. **ELECTRIC TRACING**

20.1. Electric tracing cable shall be Pyrotenax, Raychem or Thermon, for 120 volt, 1 phase supply.

20.2. Tracing cable shall be either single or double conductor embedded in a compressed mineral insulation and enclosed in a metal sheath or constant power density, cut-to-length thermo plastic insulated.

20.3. Thermostat shall be minimum 25 amp rating with adjustable control from 32deg.F (0deg.C) to 120deg.F (49deg.C) with remote bulb, 10 ft.(3m) of copper capillary. Where thermostat is mounted in conditioned areas enclosure shall be dust and moisture resistant and where mounted in non-conditioned areas enclosure shall be weather-proof.

20.4. Contactors if required shall be Allen Bradley 702L Series with 120volt coil and pilot light in cover. Provide control transformer as required.

20.5. The following minimum watts/linear foot shall be maintained.

20.6. Up to 4" pipe = 5 watts/ft. with 1" insulation

20.7. 6" pipe = 8 watts/ft. with 1" insulation

20.8. Cable shall cover the pipe for the full length shown with no gaps. Particular care shall be taken to ensure that valve body and bonnet are completely protected.

20.9. Heating cable shall be installed after pipe installation and testing is complete. Attach cable as recommended by the manufacturer with pipe straps. Cable shall not touch or cross.

20.10. Thermostat bulb shall be strapped to pipe clear of cable. Thermostat shall be mounted on wall or roof as shown with brackets. Capillary shall be hung on straps.

20.11. The entire installation shall be inspected and approved by the manufacturer before the pipe is concealed and/or insulated. Check for breaks with a 500 volt megger. Provide report for inclusion in the operating manuals. The cost of inspection shall be included in the contract price.

20.12. The installation by this section shall be complete requiring power supply only by the electrical division. Provide all wiring between the electric tracing and the electrical junction box and make final connections.

21. **NATURAL GAS PIPING SYSTEM**

21.1. All piping up to and including the meter and incoming service pressure reducing station is by Enbridge.

21.2. Paint all gas piping in its entirety in an approved colour in accordance with the Code.

21.3. Comply with Division 1, General Requirements and all documents referred to therein.

21.4. Natural Gas System shall be in accordance with Gas Utilization Code of the Department of Energy and Resources Management, Ontario.

21.5. Provide all labour, materials, products, equipment and service to supply and install the natural gas piping system indicated on the drawings and specified in this Section.

21.6. Piping shall be standard weight black steel pipe with 150 psi (1,035 kPa) malleable iron fittings or welded as accepted by authority having jurisdiction.

21.7. Valves shall be plug cocks and shall be acceptable to the authorities having jurisdiction.

21.8. Install natural gas system only with fitters certified to local Gas Utilization Regulations and CGA requirements.

21.9. Arrange and pay for a gas service to the building, including regulating station gas meter and associated accessories.

21.10. Provide all equipment and materials required for the building natural gas distribution system in accordance with the requirements of the current version of the local Gas Utilization Regulations.

21.11. Provide complete natural gas system to CGA requirements.

21.12. Provide pressure reducing, regulating and relief valving required for compatibility between equipment and building natural gas distribution system.

21.13. Provide gas pressure reducing station where noted on Drawings and where required to reduce building distribution system pressure to appliance operating pressure range.

21.14. Pressure regulators shall be spring-loaded self-operated design and shall be tight closing with replaceable orifices and discs and concealed accessible manual adjustment. Valve bodies shall be cast iron rated for 150 psi (1,035 kPa) gas pressure and all valve materials shall be painted to resist corrosive ambient conditions.

21.15. Provide pressure relief station downstream of all pressure reducing stations.

21.16. Provide relief valves of spring-loaded design with throttling characteristics to reduce system pressure surges. Valves bodies shall be cast iron rated for 150 psi (1,035 kPa) gas pressure with replaceable orifices and discs and concealed accessible manual adjustment. All valve materials shall be epoxy painted to resist corrosive ambient conditions.

21.17. Distribute gas within the building at 1 psi (7 kPa).

21.18. Select pressure reducing valves for maximum downstream capacity of the pressure reducing station served plus not less than 25%. Submit sizing data for each valve with Shop Drawings.

21.19. Pipe all relief vents individually to outdoors. Size piping for maximum pressure drop of 10% of the pressure reducing valve set point gauge pressure with a 25% capacity safety factor.

21.20. Provide upstream and downstream isolating valves and pressure gauge complete with gauge cocks at all pressure reducing stations. Connect relief valves so that they cannot be isolated from the appliances which they serve.

21.21. Connect gas piping to all gas fired equipment.

21.22. All incoming gas piping to the metering station and incoming service pressure reducing station is by Local Gas Company.

21.23. Paint all gas service piping in its entirety in all approved colour to meet code requirements.

22. **SILENCERS**

22.1. Silencers shall be Kinetics Noise Control

EQUIPMENT NO.			**S-1**		**S-2**	
Fan Served			RTU-1 Supply		RTU-1 Return	
Airflow Rate	cfm	L/s	1,500	708	1,500	708
Type			32VES-F/3-84X16X16-36/32		16VES-F/5-48X16X16-16/16	
Diameter	In	mm		--		--
Width	In	mm	16	406	16	406
Height	In	mm	16	406	16	406
Length	In	mm	84	2133	48	1220
INSERT LOSS						
63			12		2	
125			18		6	
250			24		11	
500			37		23	
Class						
Air Pressure Drop	In H2O	Pa	0.14	35	0.07	17
Remarks						
			V.Elbow		V.Elbow	

EQUIPMENT NO.			**S-3**		**S-4**	
Fan Served			RTU-2 Supply		RTU-2 Return	
Airflow Rate	cfm	L/s	2123	708	2900	1368
Type			28VES-F/2.5-84X28X28-28/28		44VES-F/5-48X22X22-12/14	
Diameter	In	mm		--		--
Width	In	mm	28	711	22	558
Height	In	mm	28	711	22	558
Length	In	mm	84	2133	48	1220
INSERT LOSS						
63			11		11	
125			18		16	
250			27		20	
500			42		26	
Class						
Air Pressure Drop	In H2O	Pa	0.18	45	0.08	20
Remarks						
			V.Elbow		V.Elbow	

EQUIPMENT NO.			**S-5**	
Fan Served			RTU-2 Return	
Airflow Rate	cfm	L/s	1600	755
Type			14VES-F/4-48X14X20-17/17	
Diameter	In	mm		--
Width	In	mm	20	508
Height	In	mm	14	355
Length	In	mm	48	1220
INSERT LOSS				
63			2	
125			6	
250			12	
500			25	
Class				
Air Pressure Drop	In H2O	Pa	0.06	16
Remarks				
			V.Elbow	

23. **CONTROLS**

23.1. All controls shall be supplied and installed by the base building control manufacturer and approved by TDSB.

23.2. Provide and install a completely functional control system that includes shop drawings, operating and maintenance manuals, material and equipment and electrical installation.

23.3. The operating and maintenance manual shall contain as built shop drawings and operating and maintenance instructions for control equipment and systems.

23.4. Provide all necessary conduit and wire to provide a complete operational system.

23.5. All wiring, except in the ceiling plenums, shall be installed in EMT conduit. Refer to the division 16000 specification for the conduit requirements.

23.6. Low voltage wiring with the ceiling plenum may be FT6 plenum rated cable, where accepted by the local authorities. The cable shall be neatly tie wrapped to conduit mounted to the building structure but must be installed on right angles or parallel to the building walls. Loose wiring shall only be allowed over a distance of 5 feet but must not pass over light fixtures.

23.7. Locations on temperature sensors are indicated on the drawings, confirm final locations with the consultant before installation. Temperature sensors shall have blank covers, may be platinum or thermistor type, with an accuracy of +/- 0.1 deg. C. at room conditions. Provide a jack at each sensor to allow a portable operating terminal to be connected to this database of the RPU-TU.

23.8. Provide all necessary control air piping. This shall include connection to the existing main air piping and all other interconnecting piping. Control piping shall be type “M” copper.

23.9. Control piping shall follow horizontal and vertical lines of the building and independently secured to the structure every eight feet as a minimum.

23.10. Plastic fire retardant tubing shall only be used from the ceiling space through a dry walled partition to a thermostat.

23.11. Provide valves to the mechanical contractor who shall install the valves under the supervision of the controls contractor.

23.12. When the installation has been completed test the operation of each control system, document the results. Forward a copy of the document to the Consultant, the original shall be included in the O&M manual.

23.13. Electric actuators shall be the piston type with bracket arrangements for location outside the air stream. The spring range and capacity of the actuator shall be suitable for the application.

23.14. Actuators used for mixing dampers shall be provided to pilot positioners which provide amplification of the electric signal and positive position adjustment for the actuator operation.

23.15. BAS thermostats shall be two pipe, main and branch control, with a single setpoint and a control range of 3-13 psig. Provide blank covers, setpoint adjustments inside cover with lockable stops.

23.16. ROOF TOP UNIT: CONSTANT VOLUME

System Start:

System start shall be initiated by operator command at the BAS or through time schedule. Upon signal to start the system supply fan shall start. Unit's internal controls shall be enabled.

Normal Operation:

Supply Fan (SFSS) shall run continuously in occupied mode.

Economizer and gas fired furnace shall be controlled by unit's internal controls to maintain the space temperature at preset set-point.

BAS shall monitor supply air temperature and return air temperature.

System Stop:

System stop is initiated by operator command at the BAS or through time schedule. Upon signal to stop the system the supply fan shall stop. Unit's internal controls shall be disabled.

Schedule:

To be determined by the owner.

Alarms:

Supply Fan Status (SFST) from current sensor.

Filter (FDP) dirty at 250 Pa (0.035 psi) pressure drop.

23.17. PRIMARY HOT WATER HEATING

Heating Flag

.1 The boiler plant shall be enabled when the heating flag is on. When the heating flag is on, the graphics shall indicate that systems are in the winter mode. When the heating flag is off, the graphics shall indicate that systems are in the summer mode.

.2

.3 The heating flag status shall be determined by the following conditions:

.1 Outdoor Air Temperature
.2 Month of the Year
.3 Lowest room space temperatures

.4 The heating flag shall be programmed to operate as follows:

MAY, JUNE, and SEPTEMBER:

.1 The Heating Flag is 'ON' when OAT is < 10℃ and the Lowest Space Temperature is < 19.7℃ in the Occupied Mode.
.2 The Heating Flag is 'ON' when OAT is < 4℃ and the Lowest Space Temperature is < 13℃ in the Unoccupied Mode.
.3 The Heating Flag is 'OFF' when OAT is > 12℃ and the Lowest Space Temperature is > 20℃ in the Occupied Mode.
.4 The Heating Flag is 'OFF' when OAT is > 6℃ and the Lowest Space Temperature is > 15℃ in the Unoccupied Mode.

JULY and AUGUST:
.1 The Heating Flag is 'OFF'.

OCTOBER to APRIL:
.1 The Heating Flag is 'ON' when OAT is < 13℃ and the Lowest Space Temperature is < 19.7℃ in the Occupied Mode.
.2 The Heating Flag is 'ON' when OAT is < 8℃ and the Lowest Space Temperature is < 13℃ in the Unoccupied Mode.
.3 The Heating Flag is 'OFF' when OAT is > 15℃ and the Lowest Space Temperature is > 20℃ in the Occupied Mode.
.4 The Heating Flag is 'OFF' when OAT is > 10ºC and the Lowest Space Temperature is > 15℃ in the Unoccupied Mode.

Heating Plant Status Flag

.5 .1 The heating plant status flag determines whether air handling systems are allowed to operate in the heating mode. The flag shall be on when all of the following conditions are true:

- the primary heating supply water temperature is above 50ºC
- at least one heating pump status (serving air handlers) is on

Primary Heating Water

.1 The boiler shall be enabled when the supply water temperature drops 3°C (adjustable) below setpoint. During the initial 3 minutes (adjustable) of boiler operation, the burner shall operate at low fire (0% command) and the P-I-D bias shall be zero (error summing is disabled). Once this time has elapsed, modulation shall be controlled by a P-I-D algorithm to maintain the supply water temperature setpoint. If at any time the supply water temperature exceeds setpoint by more than 5°C or exceeds 92°C, the boiler shall be disabled. The boiler modulation control shall be at minimum firing position before the burner is shut off.

.2 Boiler shall be equipped with a "Local/BAS" selector switch to allow the boilers to be operated manually. When switched to the "Local" position, BAS control shall be bypassed and the boiler shall be controlled by a standalone boiler controller or aquastat.

Scheduled Heating Water (Perimeter Radiation)

.1 During occupied hours and the optimum heating start mode, the base secondary supply water temperature shall be reset according to the outside air temperatures as follows:

MODE:	Outdoor Air (°C)	Supply Water (°C)
OCCUPIED	- 23	80
	5	40
UNOCCUPIED	N/A	N/A

.2 During occupied hours and the optimum heating start mode, a variable offset between 0°C and 25°C (calculated by a P-I-D algorithm) shall be added to the base secondary supply water temperature setpoint whenever the lowest classroom temperature is below the occupied space heating setpoint temperature (20°C). The maximum secondary water temperature shall not exceed 88°C at any time.

.3 During the unoccupied mode the 3-way control valve shall modulate to maintain the lowest space temperature above the unoccupied space temperature setpoint (12°C).

.4 At any time when the 3-way valve is open to supply heat to the building, to protect the boilers from thermal shock and flue gas condensation, the position of the 3-way valve shall be proportionally modulated by a P-I-D algorithm to a minimum position (30% adjustable) whenever the primary return water temperature falls below 60°C.

Optimum Heating Start

.1 The optimum heating start program shall start occupied operation of the 3-way heating valve before the actual scheduled start of the occupied mode in order to raise the lowest classroom space temperature to the occupied heating setpoint.

.2 The optimum heating start program shall commence a maximum of 3 hours (adjustable) prior to the start of the scheduled occupancy time. The actual optimum start time each day shall vary according to the outdoor air temperature, the coldest classroom temperature and the measured heating plant capacity.

23.18. Unit Ventilator

Occupied Control

.1 This unit provides heating and ventilation to the area served.

.2 The unit shall operate on a weekly schedule and holiday schedule.

.3 The unit shall stop if the boiler plant status is off and the outdoor air temperature is below 1.5°C.

.4 When the supply fan status is off, the outdoor air damper shall be fully closed and the return air damper shall be fully open. All devices shall return to their respective fail-safe positions.

.5 When the heating plant status is on, the outdoor air damper shall modulate to provide a minimum of 20% (adjustable) outside air. The percentage of outdoor air delivered shall be based on damper position. The damper shall not be allowed to open beyond minimum position (i.e. to provide free cooling) while the heating plant status is on.

.6 If the heating plant status is on and the lowest space temperature more than 2°C below the occupied winter space setpoint, the mixed air dampers shall be set to their full recirculation position.

.7 Free cooling shall be allowed when the heating plant status is off and the outdoor air temperature is less greater than 10°C and less than 60°C. When free cooling is enabled, the dampers shall modulate between minimum outdoor air position and fully open as required to maintain the space temperature setpoint.

.8 When the heating plant status is off and free cooling is not available (i.e. summer operation), the mixing dampers shall be set to a fixed position of 20% (adjustable) open. The percentage of outdoor air delivered shall be based on damper position. When the outdoor air temperature exceeds 24°C, the damper shall be set to minimum position.

.9 The space temperature setpoint shall be determined by the operating mode of the air-handling unit. The unit shall be in the heating mode when the heating plant status is on. The unit shall be in the cooling mode when chiller plant is operating or DX cooling is enabled. At all other times, the unit shall be in the free cooling mode. The supply air temperature setpoint shall be reset between minimum and maximum values by a PID algorithm to maintain the space temperature setpoint.

Operating Mode	Space Setpoint	Min. SAT	Max. SAT
Heating	20°C	N/A	N/A
Free Cooling	22°C	N/A	N/A

.10 When the heating plant status is on, the heating coil valve shall modulate to maintain the space temperature setpoint. When the heating plant status is off, the heating coil valve shall be in the fully open (relaxed) position.

Unoccupied Control

.1 The unit shall be off during unoccupied hours except for optimum heating start or night setback operation, where applicable.

.2 When the unit is off, the dampers and all other devices shall go to their respective fail-safe positions.

Optimum Heating Start

.1 The optimum heating start program shall start the unit prior to the scheduled occupied start time mode to ensure that the lowest monitored zone temperature will be at the desired setpoint for the start of the occupied mode. The optimum start time shall be a maximum of 3 hours (adjustable) prior to normal occupancy.

.2 Optimum heating start shall be allowed only when the heating plant status is on and heating water is being supplied to the unit.

.3 The dampers shall remain in the full recirculation mode during optimum heating start operation.

Night Setback Heating

.1 During the unoccupied hours, the unit shall be cycled to maintain the lowest monitored zone temperature above the unoccupied space temperature setpoint (12°C). Once enabled, the unit shall operate for a minimum of 30 minutes.

.2 Night setback operation shall be allowed only when the heating plant status is on and heating water is being supplied to the air handler.

.3 The dampers shall remain in the full recirculation mode during night setback operation.

END OF SPECIFICATION

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ELECTRICAL SPECIFICATION

PROJECT NAME:
CEDARVALE COMMUNITY SCHOOL
145 AVA ROAD
TORONTO, ONTARIO

OUR PROJECT NUMBER:
10258.001.E003

DATE:
2011-09-06

ISSUED FOR:
PERMIT AND TENDER

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END OF SECTION 16000

1. General

1.1. WORK INCLUDED

1.1.1. Conform to the requirements of Division 1, which applies to and forms part of all sections of the work.

1.2. DESCRIPTION OF SECTION

1.2.1. The specification is divided into sections of work and a section may consist of the work of more than one subcontractor. The responsibility as to which electrical subcontractor provides labour, materials, equipment and services required to complete the work rests solely with the Electrical Contractor.

1.3. SECTIONS AFFECTED

1.3.1. These instructions apply to and form a part of all electrical sections.

1.4. SCOPE

1.4.1. Provide all labour, materials, equipment and services to complete the work of the electrical division as further specified and as shown on the drawings.

1.4.2. Should any discrepancy appear between any parts of the specifications and/or the drawings to cause doubt as to the true meaning and intent of the drawings and specifications, a ruling shall be obtained from the Consultant before submitting the tender. If this is not done the following will be assumed:

.1 Where a discrepancy occurs between the specification and the drawings, the drawings take precedence.

.2 Where a discrepancy occurs in the drawings the more expensive alternative will be deemed as included in the contract.

.3 Where a discrepancy occurs in the specifications the more expensive alternative will be deemed as included in the contract.

1.5. REGULATIONS

1.5.1. All work shall be performed in accordance with the latest codes, rules, regulations, by-laws and requirements of all authorities having jurisdiction.

1.5.2. Do complete installation in accordance with current edition of the Ontario Electrical Safety Code except where specified otherwise.

1.5.3. These specifications are supplementary to the requirements above.

1.5.4. Drawings and specifications should not conflict with the above regulations but where there are apparent discrepancies the contractor shall notify the Consultant.

1.6. PERMITS, FEES INSPECTION

1.6.1. Make submissions to obtain all permits. Include for and pay for all fees and arrange for all inspections required for the work of this division.

1.6.2. If required by code, plans and specifications have been previously submitted to the Electrical Safety Authority as per Rule 2-010.

1.6.3. Furnish certificates of Acceptance from the electrical inspection department and authorities having jurisdiction and include them in the Operation and Maintenance manual.

1.7. VOLTAGE RATINGS

1.7.1. Operating voltages are as specified in CAN3-C235-83.

1.7.2. Motors, electric heating, control and distribution devices and equipment are to operate satisfactorily at 60 Hz within operating limits established by the above standard.

1.8. DEMOLITION IN EXISTING BUILDINGS

1.8.1. The contractor shall be responsible for disconnecting and removing all electrical equipment including luminaires, receptacles and wiring, including voice/data, from areas being altered or demolished. Wiring, conduit and equipment required to maintain services in other parts of the building shall be temporarily supported, rerouted, serviced or relocated as required. Obsolete conduits and cables shall be disconnected from their source of supply and removed. All existing wiring not removed shall be disconnected, made safe, identified and blanked-off.

1.8.2. All shutdowns of existing base building systems shall be coordinated with the landlord or their representative at least 10 working days in advance.

1.8.3. New conduits and other new services shall be carefully routed so that they do not interfere with any existing installations. Any existing conduits, cables, cable trays, bus ducts or other services that interfere with the new installation shall be relocated under this contract at no extra cost to owner.

1.8.4. Provide all cleanup, lifting, storage, cutting, patching and flashing as required. Remove all excess debris, material and equipment from site.

1.8.5. The existing building must be kept in operation at all times. Assume full responsibility for any disruption to existing services. Arrange work in such a manner that interruptions in services occur only at pre-scheduled times.

1.9. COORDINATION WITH MECHANICAL DIVISIONS.

1.9.1. Unless indicated otherwise on the Electrical Drawings, Electrical Contractor will be responsible for the supply and installation of the following:

.1 Starters.

.2 Line and load side wiring for starters.

.3 Reduced voltage starters including “Soft Start” starters.

.4 Line and load side wiring to variable speed drives.

.5 Provisions of disconnects to all mechanical equipment.

.6 All power wiring (120V & above) to all mechanical equipment.

.7 Electrical ramp heating cables and controls.

.8 All motorized damper power connections (120V & above).

.9 Fire alarm devices.

.10 All electrical heaters including baseboard heaters, cabinet heaters, force flow heaters and radiant heaters and wiring to electric space heaters.

1.9.2. Mechanical Divisions will be responsible for the supply and installation of the following:

.1 All variable speed drives and control wiring to starters.

.2 Pipe tracing and related controls.

.3 Electric hot water heaters.

.4 All interposing relays, relays, contactors and 120V control devices.

.5 All 120V and low voltage control wiring and conduits.

1.9.3. Determine exact location of starters, motors and line voltage controls based on the mechanical drawings to coordinate with the locations of all equipment to ensure the required clearances are maintained. If no wall location is suitable for the motor starters then mount the starters on a plywood backboard on unistrut supports near the respective equipment to meet the applicable code requirements for motor isolation switches. If a motor or piece of equipment is listed on one of the starter schedules but is not shown on the floor plans, the contractor is to reference the mechanical drawings for the location of the respective piece of equipment. No additional costs will be entertained.

1.9.4. Should the mechanical contractor change any of the motor or equipment sizes from those identified on the mechanical schedules and drawings at any stage of the project to aide their installation, the mechanical contractor will incur all extra electrical costs to revise the electrical feeders, breakers, starters and equipment to supply power to the revised piece of equipment.

1.10. PLYWOOD BACKBOARDS, EQUIPMENT MOUNTING, & HOUSEKEEPING PADS

1.10.1. Provide fire rated plywood backboards as shown on the drawings and mount where all communication equipment is to be wall mounted. Plywood is to be 21 mm (13/16 in.), be urea-formaldehyde (UF) free and be either Forest Stewardship Council (FSC), Sustainable Forestry Initiative (SFI) or CSA Z809-08 certified. Plywood to be either fire rated with the appropriate label displayed once installed or coated with fire retardant paint. All Certification not to be painted.

1.10.2. Surface mounted electrical equipment boxes are to be installed on galvanized unistrut stand-offs. Electrical equipment boxes shall include, but not be limited to electrical panels, LV lighting control, fire alarm, security, communication, electrical sub-metering, etc. Panels are to be grouped on common base wherever practical.

1.10.3. Provide steel re-enforced concrete housekeeping pads under all floor mounted electrical equipment and where noted on the drawings. All housekeeping pads to be a minimum of 100mm (4”) high above finished floor and shall not extend beyond 50mm (2”) beyond the electrical equipment unless shown otherwise on the drawings.

1.11. FINISHES

1.11.1. Metal enclosure surfaces are to be finished by the application of rust resistant primer on both the inside and outside, with at least two coats of enamel.

1.11.2. Clean and touch up all surfaces of equipment scratched or marred during shipment or installation. Match the original paint.

1.11.3. Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.

1.12. SAFETY

1.12.1. Protect exposed live equipment during construction for personnel safety.

1.12.2. Shield and mark all live parts "LIVE 120 VOLTS", or with appropriate voltage in English.

1.12.3. Arrange for the installation of temporary doors for rooms containing electrical distribution equipment. Keep these doors locked except when under direct supervision of an electrician.

1.13. FIRE STOPPING

1.13.1. Provide fire stopping in accordance with front end documents and as describe herein. Contractor to coordinate fire stopping with General Contractor.

1.13.2. Fire stopping and smoke seal systems: in accordance with CAN4 S115 M85.

.1 Asbestos free materials and systems capable of maintaining an effective barrier against flame, smoke and gases in compliance with requirements of CAN4 S115 M85 and not to exceed opening sizes for which they are intended.

.2 Fire stop system rating for service penetrations: to suit Ontario Building Code 1997, 3.1.9.1 Fire Stopping of Service Penetrations.

.3 Fire stop system rating for sealing junction of rated walls to rated floors and ceilings: to suit Ontario Building Code.

1.13.3. Service penetration assemblies: certified by ULC in accordance with CAN4 S115 M85 and listed in ULC Guide No. 40 U19.

1.13.4. Service penetration fire stop components: certified by ULC in accordance with CAN4 S115 M85 and listed in ULC Guide No. 40 U19.13 and ULC Guide No. 40 U19.15 under the Label Service of ULC.

1.13.5. Fire resistance rating of installed fire stopping assembly not less than the fire resistance rating of surrounding floor and wall assembly, and in accordance with Ontario Building Code.

1.13.6. Fire stopping and smoke seals at openings intended for ease of re entry such as cables: elastomeric seal; do not use cementitious or rigid seal at such locations.

1.13.7. Fire stopping and smoke seals at openings around penetrations for pipes, ductwork and other mechanical items requiring sound and vibration control: elastomeric seal; do not use a cementitious or rigid seal at such locations.

1.13.8. Primers: to manufacturer's recommendation for specific material, substrate, and end use.

1.13.9. Water (if applicable): potable, clean and free from injurious amounts of deleterious substances.

1.13.10. Damming and backup materials, supports and anchoring devices: to manufacturer's recommendations, and in accordance with tested assembly being installed as acceptable to authorities having jurisdiction.

1.13.11. Sealants for vertical joints: non sagging.

1.13.12. Colour: if range available to Consultant's choice of standard colours, generally to match background colour where visible in finished spaces.

1.13.13. Through non-fire or non-smoke separations or where waterproof membrane is field applied, where pipes are insulated, sleeves shall be sized to accommodate the insulation and vapour barrier.

1.13.14. Where holes are core drilled in existing structures, sleeves shall be provided as specified complete with fire stopping as noted above.

1.13.15. Submit a complete fire stopping system shop drawing package, identifying the products that may be used on the project. Prior to submitting data, review with Authority having Jurisdiction to confirm acceptability of proposed materials and assemblies.

1.13.16. Installation

.1 Install fire stopping and smoke seal material and components in accordance with ULC certification and manufacturer's instructions.

.2 Seal holes or voids made by through penetrations, poke through termination devices, and un-penetrated openings or joints to ensure continuity and integrity of fire separation are maintained.

.3 Provide temporary forming as required and remove forming only after materials have gained sufficient strength and after initial curing.

.4 Tool or trowel exposed surfaces to a neat finish.

.5 Remove excess compound promptly as work progresses and upon completion.

1.14. HOISTING

1.14.1. Electrical Contractor will be responsible for the hoisting of all the equipment in the contract. Contractor to coordinate with General Contractor for use of the general hoisting facilities. If hoist facilities are inadequate then subcontractors must provide their own. Subcontractors must inform general contractors in writing of requirements before tender closing date. Any hoisting required in addition to that provided by the General, will be included in the bid price.

1.14.2. Electrical Contractor to include for the qualified millwrights to move and place all equipment over 1000lbs. Contractor to provide proof of millwright certification.

1.15. CLEANING AND WASTE REMOVAL

1.15.1. Clean all electrical equipment that has been exposed to construction dust and dirt.

1.15.2. Contractor to clean all electrical equipment, inside and out, prior to turn over to Owner. Equipment is subject to inspection by Consultant and/or Owner.

1.15.3. Contractor is responsible to remove their own waste from the site. All re-usable materials shall be recycled.

1.16. SPRINKLERS

1.16.1. All electrical equipment shall be suitable for installation in a sprinklered environment and enclosures are to be CSA Type-2 sprinkler proof.

1.17. TEMPORARY LIGHT AND POWER

1.17.1. If required as a result from the electric service upgrade, temporary light and power for construction shall be provided, metered, and maintained by the electrical trade, as directed by the General Contractor; but each trade shall provide all extension cords, lamps, etc., required to complete their work.

1.17.2. All temporary light to be fluorescent. Provide adequate lighting to meet all health and safety standards.

1.18. EXAMINATION AND PROTECTION OF SITE

1.18.1. Before submitting Bid, each trade shall examine the site to determine the conditions which may affect the proposed work. No claims for extra payment will be considered because of failure to fulfil this condition.

1.18.2. Contractor to document any existing conditions on site and submit a pre-condition survey including pictures. Contractor will be responsible to return the site back to its original form, which includes but is not limited to ground repair including grading and new sod and repair of damaged walls, doors and/or floors.

1.18.3. Contractor is to protect trees and plants on site and on adjacent properties. Plants to be protect with burlap. Trees and roots within construction area to be protected by the erection of temporary 2m high plywood hoarding at the drip line of the tree. Contractor to avoid unnecessary traffic, dumping and storage of materials at or near trees or plants.

1.18.4. When requested by the Owner and/or Consultant, the Contractor is to provide digital pictures of the site, including but not limited to progress of work and installed equipment, via e-mail to the Owner and/or Consultant.

1.19. DRAWINGS AND INSTALLATION

1.19.1. The drawings are intended to show the general character and scope of the work and not the exact details of the installation. The installation shall be complete with all accessories required for a complete and operative installation.

1.19.2. The location, arrangement and connection of equipment and materials shown on the drawings represent a close approximation to the intent and requirements of the contract. The right is reserved by the Consultant to make reasonable changes required to accommodate conditions arising during the progress of the work, at no extra cost to the Owner.

1.19.3. Certain details indicate on the drawings are general in nature and specific labelled detail references to each and every occurrence of use are not indicated, however, such details shall be applicable to every occurrence on the drawings.

1.19.4. The actual location of switches, outlets and luminaries, etc. shall be reviewed by the Consultant before installation.

1.19.5. The location and size of existing services shown on the drawings are based on the best available information. The actual location of existing services shall be verified in the field before work is commenced. Particular attention shall be paid to buried services.

1.19.6. Changes and modifications necessary to ensure co-ordination and avoid interference and conflicts with other trades or to accommodate existing conditions, shall be made at no extra cost to the Owner.

1.19.7. Leave areas clear where space is indicated as reserved for future equipment, and equipment for other trades.

1.19.8. Adequate space and provisions shall be left for removal of components and servicing of equipment, with minimum inconvenience to the operation of systems.

1.19.9. Where equipment is shown to be 'roughed-in only' obtain accurate information from the Consultant before proceeding with the work.

1.19.10. Contractor is to review Architect's specifications, drawings and details to confirm locations of devices and equipment.

1.19.11. This Contractor is responsible to mark-out his work, fully co-ordinated with all other trades, in sufficient time for review by Architectural Consultant prior to rough-in. Prepare dimensioned layouts of each room prior to rough-in for review by Architectural Consultant. Do not proceed with any work until the Architectural Consultant has reviewed the layout drawings.

1.19.12. The Contractor will reimburse the Consultant for their time spent on answering any written questions or requests for information where the answer is clearly identified on the drawings or in the specifications.

1.20. INSTALLATION, INTERFERENCE AND SETTING DRAWINGS

1.20.1. The Contractor is to complete installation, interference and setting drawings, dimensioned and to scale for all systems. They shall be made available for review by the Consultant, if requested. The drawings are required to make clear the work intended or to show its relation to adjacent work or to the work of other trades. When an alternative piece of equipment is to be substituted for equipment shown, drawings of the area involved shall be prepared by this division.

1.20.2. Slab layout drawings are to be submitted for review by the Structural Consultant. These slab layout drawings are to be included in the as-built drawings. Refer to Section 16030 – RECORD DRAWINGS.

1.20.3. Interference drawings are required for shafts, ceiling spaces, basement areas, typical floors and wherever there is possible conflict in the positioning of electrical equipment, piping, ductwork sub-trades or architectural features.

1.20.4. This Division shall prepare sleeving drawings indicating the size and locations of openings required in concrete floor slabs, roof slabs/decks and walls for conduit, bus ducts and equipment for review by the Structural Engineer and Architect. In case of failure to provide information in time (i.e. before the concrete is poured) any extras incurred shall be at the expense of this Division.

1.21. SUPPLEMENTARY BID FORM AND SUBMISSIONS OF BID

1.21.1. Submit with tender, if included in the documents, a complete Electrical Supplementary Bid Form. Tenders not completed in full may, at the discretion of the Owner be rejected.

1.21.2. Several alternative, separate and itemized prices may have been requested. These shall be completed on the Electrical Supplementary Bid Form. Refer to the specific sections of the specifications and to the drawings for details.

1.22. APPROVED MANUFACTURERS

1.22.1. Where only one name appears in the specification, the bid shall include for the specified equipment.

1.22.2. Where two or more names are shown in the specifications as alternates or equal to, this division can select which manufacturer is to be carried.

1.22.3. The Contractor is to list substitute equipment as a price deduction to the Bid Price on the Electrical Supplementary Bid Form. Space has been provided to show manufacturers not specifically mentioned. Acceptance of substitute equipment shall be at the discretion of the Owner and/or Consultant. Any substitutes not listed on the Electrical Supplementary Bid Form will not be entertained.

.1 The proposed substitution shall show product name and complete description and also what difference, if any, will be made in the amount of the Bid Price for each substitution, should it be accepted.

.2 Materials and products specified by the name of the manufacturer, the brand or trade name, or catalogue reference, shall be the basis of the Bid Price.

.3 Any alternate and/or substitute equipment listed shall be equal in performance and quality to that specified. If space, power, structural or any other requirements are different from the equipment specified, the cost of any changes shall be included for in the price shown on the Electrical Supplementary Bid Form.

.4 The Owner reserves the right to accept or reject any substitution without question.

.5 The "Base and Alternate Equipment" is for North American manufactured products. Where a listed manufacturer can offer either North American or non- North American source for the equipment, the country of origin shall be shown under "Substitute Equipment" and the cost savings shown under "Deduct From Tender Price".

1.23. PRODUCTS AND MATERIALS

1.23.1. Make and quality of materials used in the construction of this project shall be subject to the approval of the Consultant.

1.23.2. All equipment and material are to be CSA certified or approved by an accredited organization. Where there is no alternative to supplying equipment which is not CSA certified, obtain special approval from Electrical Inspection Authorities.

1.23.3. Factory assembled control panels and component assemblies.

1.23.4. Materials and equipment supplied by this division shall be new and free from defects and shall be equivalent in physical characteristics and performance to that specified by the manufacturer's name and catalogue reference.

1.23.5. Where a certain manufacturer's equipment has been specified by name or model number, the contractor shall be responsible for ensuring that the performance and quality meets the specified equipment and that the same access or maintenance space is available for an alternative manufacturer's equipment that is used and that interfacing connections with other trades can be made at no extra cost.

1.23.6. Within 30days of the award of contract, the Contractor is to submit a complete list of the manufacturers for all equipment being supplied on the project.

1.23.7. Availability

.1 In submitting Bid, Contractor warrants that all materials are available in suitable time to meet Contract dates.

.2 Subject to sentence .3 below, where the Contractor advises that the Contractor cannot supply materials in suitable time to meet Contract dates, and should it subsequently appear that Work may be delayed for such reason, the Consultant reserves the right to substitute more readily available products of similar character, even if more costly to the Contractor, at no increase in Contract Price.

.3 Where the Contractor can show that the Contractor promptly ordered the originally specified materials the Owner will pay the differential in cost between the originally specified material and the substitute material with out any mark-ups applicable by the Contractor, subcontractors, subsubcontractors or suppliers. For greater certainty, the Contractor’s failure to submit shop drawings or other submittals or seek direction in those instances where the Contract Documents so require in sufficient time to permit ordering materials is not cause for the Owner to pay the cost differential in sentence .2 above.

1.24. CO-OPERATION WITH OTHER DIVISIONS

1.24.1. Particular attention must be paid to the proximity of electrical conduit and cable to mechanical piping and equipment.

1.24.2. Electrical conduits shall not touch or be supported on pipe or duct walls.

1.24.3. Each section shall confine itself to installing all materials in the spaces shown without encroaching upon space for materials installed under other sections or divisions. Where the space allocated to another section or division is encroached upon, the materials shall be relocated to their proper space allocation in such a manner to complete the work using space allocated to the various sections and divisions. Relocation of materials and work involved shall be paid for by the section responsible for the encroachment at no extra cost to the Owner.

1.24.4. The supply of all items is to have built-in to the delivery schedule, ample time for rapid progress of work. Proceed with work determined by the construction schedule.

1.25. STATEMENT OF PRICES

1.25.1. To form a basis for progress payments the successful bidder shall submit a sample progress draw for the various portions of the work, including both labour and materials. The total price of all portions of the work shall equal the total price of the work covered under the electrical division. Cost for as-builts and manuals to be carried as a separate line item.

1.25.2. Contractor to list and track all cash allowances on separate lines on the progress draw.

1.25.3. Contractor to list and track each of the approved changes on separate lines on the progress draw.

1.25.4. Costs of temporary facilities and utilities shall be amortized over the duration of the Work. Claims for 'mobilization', 'bidding costs', or similar lump sums at or before start of work are not acceptable.

1.26. METRIC CONVERSIONS

1.26.1. Particular care shall be taken with imperial versus S.I. metric conversions. This applies to all services including, but not limited to, equipment, conduit and site services in both new and existing installations.

1.27. INTERRUPTION OF SERVICES

1.27.1. Any interruption of the electrical services to any part of the building shall come at a time agreeable to the Consultant. Make all necessary arrangements with those concerned and include for any overtime required to ensure that the interruption is held to a minimum.

1.27.2. Testing and operation of major equipment shall be approved by the Consultant to avoid excessive hydro electric charges. Such testing to be generally carried out after normal working hours or on weekends.

1.27.3. All such overtime work shall be carried out without additional cost to the Owners.

1.27.4. Modifications to existing electrical equipment, which will require shutdown, must be coordinated with the Owner and will only be permitted on weekdays from 10:00 pm to 6:00 am and on weekends from Friday at 7:00 pm to Sunday 6:00 pm. Exact weekends to be co-ordinated with the Owner. Consecutive weekends of shutdowns will not be allowed. Contractor to pay for all Hydro costs associated with shutdowns. Any work not associated with live equipment can be done during normal working hours. Work considered disruptive to the normal operation of the building will be done after normal business hours. Exact times to be co-ordinated with Owner.

1.27.5. Contractor to provide a minimum of 5 days written notice of a requirement for a shutdown. Contractor to include for separate meetings with the Owner and Consultant to discuss the shutdown in detail and to coordinate all the work being performed.

1.27.6. The Contractor is responsible for co-ordination and isolating of all existing services at all voltage levels required the disconnections and connections to existing buildings. This includes

shutting down and isolating existing low and medium voltage services. The owner will not perform any isolations for the contractor but will be present during the work. The contractor is to use qualified personnel for these shutdowns ensuring compliance with all applicable safety requirements.

1.27.7. The Contractor is responsible for any damages caused to existing systems when making connections.

1.27.8. The Contractor is to keep shutdowns of existing buildings to a minimum by scheduling the work and providing the required number of personnel to keep the shutdown to a minimum. This Contractor is to include for as many multiple teams of electricians is feasible to keep the shutdown work to the minimum.

1.28. VALUATION OF CHANGES

1.28.1. Further to contract requirements, the method to be used in determining the value of a change to the Work, by either Change Order or Change Directive, shall be:

.1 Estimate and acceptance in a lump sum, unless the Consultant otherwise determines that the method shall be unit prices set out in the Contract.

1.28.2. Contractor shall provide the Consultant with a detailed cost analysis of the contemplated change indicating:

.1 Quantity of each material.

.2 Unit cost of each material.

.3 Time involved.

.4 Sub-trade quotations including a complete analysis of costs.

.5 Mark-ups, if applicable.

.6 Value of GST or HST, as applicable.

.7 Proposed change in Contract Time.

The detailed cost breakdown is to list material and labour separately for each item on the proposed change. The breakdown for contemplated change is to follow the format of the attached document.

1.28.3. The following shall not be included in the cost of the work but are covered by the allowance (mark-ups) for overhead and profit:

.1 The Contractor’s head office and site office expenses, including stationary, postage and other office supplies.

.2 The costs of the Contractor’s Project Manager, clerical and administrative personnel, and executive personnel.

.3 Use of temporary offices, sheds, small tools, etc., including the cost of telephone, light, power, water and heat used therein,

.4 Transportation and overnight room expenses for out of town labour, if local labour is unavailable.

.5 Insurance premiums.

.6 Licenses and permits, except when these are special for a particular item of work.

.7 Printing charges for Proposed Changes, Change Orders and Drawings for Contractor's and Subcontractors' use in the work. Consultant will provide one copy of change notice documentation and in the event of re-issue of full size drawings will provide one print.

.8 The cost of record drawings and shop drawings.

.9 The cost of clean up and disposal of waste material.

.10 Parking.

1.28.4. The Contractor shall not be entitled to any additional compensation arising out of changes to the Work other than the amounts determined and agreed to under CCDC2-1994 GC 6.2.

1.28.5. The maximum percentage fee for mark-ups shall be as stated below.

1.28.6. In computing accounts for extras and credits for any Proposed Change, all credits shall be deducted from the total sum of the extras before mark-ups or charges for overhead and profit are added.

1.28.7. The Contractor shall inform the Surety Company or Companies who have issued any bonds for this Contract, and any Insurers who have insured any apart of the work or operations or who have an interest in this Contract, of all changes in the Contract. Pay all costs of any changes in bonds or insurances required to maintain bonds or insurances in conformance with the requirements of the Contract Documents. Provide Owner immediately with any revised bonds or insurances.

1.28.8. Special equipment rental rates will be charged at cost.

1.28.9. Permitted Mark-Ups

.1 The following maximum net overhead and profit mark-ups by Contractors will be permitted for extra work under Change Order or Change Directive:

Cost of Extra Work, not including GST or HST, as applicable	Contractor's Mark-Up on Work of Own Forces (%)	Contractor's Mark-Up on Subcontracted Work (%)
$0 to $5,000	10	7
>$5,000 to $10,000	10	7
>$10,000 to $50,000	7	5
>$50,000	5	4

.2 The following maximum net overhead and profit mark-ups by Subcontractors will be permitted for extra work:

Cost of Extra Work, not including GST or HST, as applicable	Contractor's Mark-Up on Work of Own Forces (%)	Contractor's Mark-Up on Subcontracted Work (%)
$0 to $5,000	10	7
>$5,000 to $10,000	10	7
>$10,000 to $50,000	7	5
>$50,000	5	4

.3 Where a proposed change order includes both credits and extras, overhead and profit mark-ups apply to the net extra or credits, if any, of the entire change.

1.28.10. All changes, change notices, revisions to contract, site instructions, change directives or any additional costs or deletes to the stipulated lump sum contract price are subject to review and scrutiny by a qualified third party or individual.

1.28.11. Labour Rate

.1 During the duration of the electrical contract, extra work hourly labour units are to be based on the latest edition of the National Electrical Contractors Association (NECA) labour units column 1(one). No additional factors will be accepted.

.2 The hourly labour rate for all changes will be based on a Journeyman Electrician rate as listed on the Electrical Supplementary Bid Form. The Owner and/or Consultant reserve the right to renegotiate the labour rate. The hourly labour rate will be exclusive of overhead and profit. The labour rate will be inclusive of all labour burden charges including: payroll and administrative burdens, all government payroll burdens, variable labour factors and union or association funds. The following labour burdens are not part of the hourly labour cost and are covered under overhead and mark-up or under the NECA labour unit rates: all supervision, hand tools, warranties, storage, rentals, parking, clean-up, additional bonding, as-built drawings, material sorting/handling/hoisting, project financing, coffee break/rest periods, safety training including safety talkings, WHMIS and the health and safety committee, non-productivity time and site office and consumables.

.3 At the request of the Owner or the Consultant, the Contractor is to submit a detailed labour cost breakdown showing a breakdown of all adders to the base wage rate to show how the Contractor has come to the proposed hourly rate. The Owner and the Consultant reserve the right to negotiate the hourly labour rate with the Contractor.

PROPOSED CHANGE ORDER

Company Name:	CCN #
Address:	Date:
City, Prov.:	Project Name:
Postal Code:	Project Number:
	Page Number:
Telephone:	Change Order #:
Fax:	
E-Mail address:	
Client Address:	

Work Description

We reserve the right to correct this quote for errors and omissions.
This quote covers direct costs only.
This price is good for acceptance within 30 days from the date of receipt.

Itemized Breakdown

Description	Qty	Net Price U	Total Mat($)	Labor U	Total Hours
¾' EMT		150.39 C		5.00 C	
¾' EMT STL SS CONN		65.97 C		10.00C	
¾' EMT STL SS CPLG		70.60 C		5.00 C	
¾' EMT STRAO 1-H		11.24 C		4.00 C	
#8 TO 10 x 7/8" PLAS ANCHOR (3/16)		6.05 C		5.00 C	
#10 x 1" SELF TAPPING SCREW		5.50 C		5.5 0 C	
TOTALS					

Summary

Description		Total Hours
General Materials		
Material Tax	(@ 15.000 %)	
Material Total		
JOURNEYMAN	(xx Hrs. @ $xx.00)	
Subtotal		
OVERHEAD AND MARK-UP		
Overhead/Mark-up	(@ 10.000 %)	
Subtotal		

Final Amount

1.29. DEMOLITION

1.29.1. The demolition drawings show the general scope of the demolition and not exact details or total extent. For exact details and total extent each service must be carefully checked on site. Before removing services follow the service through to ensure other areas of the building are not affected.

1.29.2. Whenever existing services or equipment are to be removed, all electrical connections for such services shall be removed and securely terminated in an approved manner. If necessary to facilitate installation of new work, any existing services and equipment shall be removed and then replaced by this division.

1.29.3. Whenever it becomes necessary to relocate any electrical services equipment to make possible installation of the work under this contract, such relocation shall be done by this division without additional cost to the Owner.

1.29.4. Make safe and disconnect all power and systems, as and when, and to the extent required to facilitate with the demolition.

1.29.5. Ensure that all electrical, life safety services, and services for existing equipment, in areas outside the areas of this work, that are required to remain in service, shall do so.

1.29.6. Relocate any electrical feeders or equipment that are required to remain in service, that are secured to existing walls, floors or ceilings to be demolished or that are buried and required to be excavated for new work.

1.29.7. Remove and replace any electrical equipment on walls or ceilings that will be demolished and rebuilt.

1.29.8. Disconnect and remove existing light fixtures, devices, outlets, CCTV, security devices, etc. which are not to be reused. Such items shall be cartoned and turned over to the Owner at a place designated by the Owner. Cut back and cap unused raceway and outlets and remove unused wiring back to panelboard in an approved manner.

1.29.9. Ensure that all existing equipment which is to be reused and/or relocated is thoroughly inspected and refurbished to ensure correct operation when put back into service and to meet the requirements of the local authorities having jurisdiction. All existing electrical equipment which is no longer required shall be removed and disposed of off site.

1.29.10. Carry out the work with a minimum of noise, dust and disturbance.

1.29.11. Provide tools and clean up equipment. Obtain the Owner's permission for the use of electrical, plumbing or drainage outlets.

1.29.12. Where a device is shown to be relocated on the drawings, contractor to remove and re-install device and back box and re-feed the device with new conduit and wire from the nearest existing accessible junction box.

1.29.13. Electrical Contractor is responsible for the patching and re-painting the entire wall where a device and/or box has been added, removed or relocated.

2. Products

2.1. NOT USED

3. Execution

3.1. NOT USED

END OF SECTION 16010

1. General

1.1. ABBREVIATIONS

1.1.1. Abbreviations for electrical term areas specified in CSA Z85-1983.

2. Product

2.1. NOT USED

3. Execution

3.1. NOT USED

END OF SECTION 16012

1. General

1.1. WORK INCLUDED

1.1.1. Section 16010 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS

1.1.2. Section 16115 – BUSWAYS

1.1.3. Section 16121 – POWER CABLE AND OVERHEAD CONDUCTORS

1.1.4. Section 16322 – DRY TYPE POWER TRANSFORMERS

1.1.5. Section 16344 – METAL ENCLOSED SWITCHGEAR

1.1.6. Section 16346 – METAL CLAD SWITCHGEAR

1.1.7. Section 16402 – SERVICE ENTRANCE BOARD

1.1.8. Section 16421 – SWITCHBOARDS

1.1.9. Section 16426 – SECONDARY SWITCHGEAR

1.1.10. Section 16450 – GROUNDING AND BONDING

1.1.11. Section 16476 – AIR CIRCUIT BREAKERS

1.1.12. Section 16477 – MOULDED CASE CIRCUIT BREAKERS

1.1.13. Section 16480 – SURGE PROTECTION DEVICE

1.1.14. Section 16492 – GROUND FAULT EQUIPMENT PROTECTION

1.2. REFERENCE

1.2.1. ANSI/NETA MTS-2007 - Standard For Maintenance Testing Specifications For Electrical Power Distribution Equipment And Systems

1.3. OVERVIEW

1.3.1. As part of this project, start up services will be performed on the electrical distribution and control equipment as specified. This specification is intended as a part of the electrical portion of this project.

1.3.2. The start-up service company must follow jobsite electrical safety requirements, installation standards and electrical testing standards.

1.3.3. Documentation of all procedures performed shall be provided. 3 copies shall be provided and forwarded to the engineer. Written documentation must contain recorded test values of all electrical tests performed per the individual product specification.

1.3.4. Start-up service scheduling must be available through a 24 hour, toll free national dispatch system.

1.3.5. The start-up service company shall be present during energization of the distribution equipment. Jobsite and equipment access must be provided by the electrical contractor.

1.3.6. The contractor shall supply a power source, specified by the start-up service company, for on-site test equipment.

1.3.7. The contractor is to attend all factory witness testing required within the respective specification sections. The contractor is responsible to cover all their costs and include them in their bid.

2. Product

2.1. GENERAL

2.1.1. Conduct the following tests, at time suitable to Engineer, with Engineer present as witness.

2.1.2. Perform tests using qualified personnel. Provide necessary instruments and equipment.

2.1.3. Check each feeder for continuity, short circuits and grounds. Ensure resistance to ground of circuits is not less than 50 megohms.

2.2. INSPECTION AND TEST PROCEDURES

2.2.1. Perform all testing identified in the ANSI/NETA MTS-2007 standard in addition to the following tests.

2.2.2. Switchgear and Switchboard Assemblies

.1 Visual and Mechanical Inspection

.1 Assemblies shall be inspected for physical damage.

.2 Bussing compartment inspection shall include the following:

.1 Check tightness of accessible bolted bus joints by torque wrench method.

.2 Check insulators for cracks and contamination.

.3 All electrical, key, and mechanical interlock systems shall be verified for correct operation.

.4 Closure shall be attempted on locked open devices. Opening/withdrawal attempt shall be made on locked closed devices.

.5 Mechanical operations of circuit breaker in cell shall be checked and auxiliary devices activated.

.6 Drawout trays, contact alignment, ease of operation, proper grounding, and interlocks shall be checked.

.7 Circuit breaker cell shall be inspected for contamination, physical damage, loose hardware, shutter mechanism, control plug, guide rail, floor nameplates, ground bus, auxiliary contacts, and linkages.

.8 Circuit breaker shall be inspected for contamination, physical damage, main finger/stab penetration and secondary connections.

.2 Electrical Tests

.1 Insulation resistance of each bus section shall be measured phase-to-phase and phase-to-ground.

.2 Overpotential test shall be performed for each bus section, phase-to-phase and phase-to-ground for medium voltage equipment,

.3 Electrical operation of the circuit breaker shall be checked in the test and connected position.

.4 The control power source shall be checked.

.5 The circuit breaker control scheme shall be tested.

.6 A phasing check shall be made on double-ended and/or emergency source switchgear at tie points to ensure correct bus phasing.

.3 Test Values

.1 Bolt torque levels are checked in accordance with manufacturer's specifications.

.2 Insulation resistance testing is to be performed in accordance with the manufacturer's recommendations.

2.2.3. Circuit Breaker-Low Voltage Drawout, Or Fixed Insulated Case

.1 Visual and Mechanical Inspection

.1 Inspect physical condition, cleanliness and nameplate compliance with single-line diagram.

.2 Check drawout mechanism, lubrication and grounding (if applicable).

.3 Check all indicating devices for proper operation.

.4 Check cell fit and element alignment.

.5 Check primary stab penetration (if applicable).

.6 Check secondary connections with the circuit breaker in the connected and test positions (if applicable).

.7 Bolt torque levels are checked on all accessible hardware in accordance with manufacturer's specifications.

.2 Electrical Tests

.1 Contract resistance is measured.

.2 Insulation resistance is checked phase-to-phase, phase-to-ground, and across open contacts at 1000 VDC.

.3 Minimum long-time pick-up current is determined when possible; delay time determined at 300% of pick-up by secondary injection.

.4 Short-time pickup and time delay is determined by secondary injection.

.5 Instantaneous pickup current is determined by secondary injection.

.6 Ground fault pickup current and time delay is determined by secondary injection.

.7 Trip unit reset characteristics are verified.

.8 Final settings are made in accordance with customer's prescribed settings.

.9 Auxiliary devices, such as under voltage relays, blown main fuse detector, shunt close, shunt trip, spring charging motor, and auxiliary contacts are activated to ensure operation as applicable.

.10 Secondary Current Injection shall be performed on the power circuits.

2.2.4. Circuit Breaker-Low Voltage (Molded Case)

.1 Visual and Mechanical Inspection.

.1 Circuit breaker is checked to insure smooth operation.

.2 The case is inspected for cracks or other defects.

.3 Bolt torque levels are checked in accordance with CSA Standards or manufacturer's specifications.

.2 Electrical Tests on Breakers of 100 Amps or Larger

.1 Contact resistance measuered.

.2 Insulation resistance is checked at 1000 VDC for one minute from pole to pole and from each pole to ground and across open contacts of each phase.

.3 Test trip release on each circuit breaker.

.4 Minimum long-time pick-up current is determined when possible. Long-time delays is determined by secondary current injection method at 300% of rating.

.5 Instantaneous pick-up current determined by secondary injection using run-up or pulse method.

2.2.5. Power and Insulated Case Circuit Breakers-Low Voltage

.1 Visual and Mechanical Inspection.

.1 Check mechanical operation.

.2 Cell fit and element alignment are checked.

.3 Bolt torque levels are checked in accordance with CSA Standards or manufacturer's specifications.

.4 Check arc chutes for foreign matter, cracks and secure installation.

.5 Clean primary contact surfaces and lubricate if required.

.2 Electrical Tests

.1 Contact resistance is measured.

.2 Insulation resistance is checked at 1000 VDC for one (1) minute from pole to pole and from each pole to ground and across open contacts of each phase.

.3 Minimum long-time pick-up current is determined when possible; delay time is determined at 300% of pick-up by secondary injection.

.4 Short-time pick-up and time delay is determined by secondary injection.

.5 Instantaneous pick-up current is determined by secondary injection.

.6 Ground-fault pick-up current and delay is determined by secondary injection.

.7 Trip unit reset characteristics are verified.

.8 Final settings are made in accordance with Engineer's prescribed settings.

.9 Auxiliary devices, such as under voltage relays, blown main fuse detector, shunt close, shunt trip, spring charging motor and auxiliary contacts are activated to ensure operation as applicable.

.10 All functions of the trip units will be tested with test kits.

.11 Secondary Current Injection shall be performed on the power circuits.

2.2.6. Air Switches-Low and Medium Voltage

.1 Visual and Mechanical Inspection

.1 Inspect the switch for physical damage, proper installation, anchorage, and grounding.

.2 Inspect interior insulation arc chutes and interphase barriers.

.3 Perform mechanical operator tests. Clean and lubricate as necessary.

.4 Check blade alignment and arc interrupter operation.

.5 Check fuse linkage and element for proper holder and current rating. Record fuse data.

.6 Check key interlock for safe operation and proper key distribution.

.2 Electrical Tests

.1 Overpotential test voltages are applied phase-to-phase and phase-to-ground.

.2 Contact resistance is measured across each switch blade and fuse line, measured in micro-ohms.

.3 Perform insulation resistance test on each phase-to-ground and from phase-to-phase.

2.2.7. Protective Relays

.1 Visual and Mechanical Inspection

.1 Inspect relays for physical damage, presence of foreign material and moisture.

.2 Check conditions of spiral spring, disc clearance and corrosion (if present). Inspect cover glass interior and relay components.

.3 Check for mechanical freedom of movement, proper travel and alignment, and tightness of mounting hardware and tap screws.

.2 Electrical Tests

.1 This test is only performed on wiring to non-solid state relays

.2 The following tests are performed at settings specified by the Engineer:

.1 Pickup parameters on each operating element.

.2 Timing at three (3) points on the time dial curve.

.3 Pickup target and seal in units.

.4 Operation of restraint, directional, and other elements are checked as required.

.3 Phase angle and magnitude contribution tests are performed on all differential and directional type relays after energization to vectorially prove proper polarity and connection.

2.2.8. Instrument Transformers

.1 Visual and Mechanical Inspection

.1 Inspect for physical damage and compliance with single-line diagram.

.2 Check mechanical clearance and proper operation of all disconnecting and grounding devices.

.3 Verify proper operation of grounding or shorting devices.

.2 Electrical Tests

.1 Current transformer ratio is measured by primary current injection, or voltage method.

.2 Potential transformer ratio is measured.

.3 Insulation resistance is measured primary to ground, secondary to ground, and primary to secondary.

.4 Secondary wiring connections are verified by secondary current injection.

.5 Transformer polarity markings are verified.

2.2.9. Grounding Systems

.1 Visual and Mechanical Inspection.

.1 Inspect ground system for compliance with plans and specifications.

.2 Electrical Tests.

.1 The fall of potential test is performed per IEEE Standard No. 81, Section 9.04 on the main ground electrode or system.

.2 The two (2) point method test is performed per IEEE Standard No. 8`, Section 9.03 to determine the ground resistance between the main grounding system and all major electrical equipment frames, system neutral and/or derived neutral points.

2.2.10. Ground Fault Systems (NEC 230-95)

.1 Visual and Mechanical Inspection.

.1 Monitor panels (if present) shall be manually operated for both trip test and no trip test.

.2 Electrical Tests.

.1 System neutral insulation resistance is measured to insure no shunt ground paths exist. The neutral ground disconnect link is removed, neutral insulation resistance measured and the link replaced.

.2 The relay pickup current is determined by primary injection at the sensor and the circuit interrupting device operated.

.3 The relay timing is tested by injecting one hundred fifty percent (150%) and three hundred percent (300%) of pickup current into sensor. Total trip time is electrically monitored.

.4 Zone interlock systems are tested by simultaneous sensor current injection and monitoring zone blocking function.

.5 Verify that system will operate at 57% rated control voltage (if applicable).

.3 Test Parameters.

.1 System neutral insulation resistance will be a minimum of preferably one (1) megohm or greather.

.2 Relay pickup current will be within ten percent (10%) of device dial or fixed setting, and in no case greater than twelve hundred (1200) amperes.

.3 Relay timing will be in accordance with published time-current characteristic curves, but in no case longer than one (1) second.

2.2.11. Metering and Instrumentation.

.1 Visual and Mechanical Inspection.

.1 Verify meter connections in accordance with single-line meter and relay diagram.

.2 Inspect for physical damage.

.2 Electrical Tests.

.1 Ammeter accuracy is checked using current injection.

.2 Voltmeter accuracy checked.

2.2.12. Transformers-Dry Type

.1 Visual and Mechanical Inspection.

.1 Verify the operation of auxiliary devices, such as fans, pumps, sudden pressure device, indicators, tap changer, and gas pressurization system.

.2 Bolt torque levels are checked in accordance with CSA Standards or manufacturer's specifications.

.3 Inspect primary and secondary connections for tightness and for signs of overheating.

.4 Inspect and clean bushings and insulators.

.5 Check fuses for correctness of type and size.

.6 Check for grounding and neutral continuity between primary and secondary circuits of transformer.

.2 Perform tests in accordance with Section 16010 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS and this section. Tests shall be conducted in accordance with the provisions of ANSI C57.12.91.

.3 As a minimum perform the following tests:

.1 Resistance Measurements

.2 Turns ratio test is performed between windings for all tap positions.

.3 Polarity and phase rotation.

.4 Excitation Current and no load losses on rated voltage and 110% of rated voltage.

.5 Impedance and load loss.

.6 Applied potential.

.7 Induced potential.

.8 Pressure test.

.9 Core insulation test.

.10 Insulation power factor test.

.11 Insulation resistance tests are performed winding to winding and winding to ground.

.4 Carry out following insulation tests using a 1,000kV megger with 20,000 megohm scale and resulting insulation resistance corrected to base of 20 deg. C. (68 deg. F.).

.1 High voltage to ground with secondary grounded for duration of test.

.2 Low voltage to ground with primary grounded for duration of test.

.3 High to low voltage.

2.2.13. Cables-Medium Voltage

.1 Visual and Mechanical Inspection

.1 Inspect exposed cable section for tracking corona or physical damage.

.2 Inspect shield grounding, cable support, and termination.

.3 Apply grounds upon completion to drain all absorbed potential to zero volts.

.2 Pre-acceptance tests:

.1 After installing cable but before splicing and terminating, perform insulation resistance test with 10000 V megger on each phase conductor.

.2 Check insulation resistance after each splice and/or termination to ensure that cable system is ready for acceptance testing.

.3 Verify phasing of cabling.

.3 Acceptance Tests:

.1 Electrical Tests (New continuous cable i.e. Not spliced to old cable)

.1 A dc hi-potential to be applied in at least five (5) equal increments until maximum test voltage is reached. DC leakage current to be recorded at each step after a constant stabilization time, consistent with system charging current delay.

.2 Perform shield continuity test.

.3 Terminations to be corona suppressed by guard ring, field reduction sphere or other suitable methods.

.4 Each conductor to be individually tested with all other conductors grounded. All shields are to be grounded.

.5 Perform dc hi-potential test using step voltage method. Maximum test voltage shall be in accordance to the ICEA and manufacturer's recommended levels.

.2 Existing Cables

.1 Existing cables insulation resistance to be tested using a 10kV megger before cables are cut into for splicing and again after splicing of new cables is complete prior to re-energization.

2.3. INFRARED SCANNING

2.3.1. Two months after the occupancy of the building by the Owner the Contractor is to infrared scan the entire electrical distribution system up to and including all panelboards.

2.3.2. Contractor to re-scan the entire electrical distribution system up to and including all panelboards two months prior to the completion of the warranty period.

2.3.3. Contractor to use current infrared detection technology.

2.3.4. Contractor is to provide a complete report, identifying areas of concern. Contractor to provide copies of all infrared video taken on DVDs to the Owner for their records.

2.3.5. Electrical Contractor is to repair any loose connection/terminations or replace any faulty equipment under warranty.

2.4. REPORTS

2.4.1. Provide Consultant with list of test results showing location at which each test was made, circuit tested and result of each test.

2.4.2. Assemble all testing results into a common binder and organize based on specification sections. Include all manufacturer testing results. Submit 3 copies of this manual along with the Operation and Maintenance manuals.

2.5. ACCEPTABLE CONTRACTORS

2.5.1. The work in this section is to be performed by:

.1 Schneider Services

.2 Cutler Hammer Services

.3 Siemens Services

.4 GT Wood

.5 Pelikan

.6 Rondar

.7 Eastenghouse

3. Execution

3.1. NOT USED

END OF SECTION 16025

1. General

1.1. WORK INCLUDED

1.1.1. Refer to Section 16010 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

2. Products

2.1. RECORD DRAWINGS

2.1.1. The Electrical Contractor shall request in writing from the Consultant all electrical AutoCAD drawings. Contractor to complete attached form and pay the Consultant directly the costs identified within the form prior to receiving the drawings. After the final as-built drawings have been reviewed, provide multiple copies of the drawings on CD or DVD. One copy is to be returned to the Consultant for their records and a minimum of one copy with each set of maintenance manuals. Provide additional copies if required under the General Conditions. The Contractor is to use latest release of AutoCAD software.

2.1.2. The contractor to identify the cost of Record Drawings and the Operation and Maintenance Manuals as a separate line item on their progress draw. The following values are to be broken out:

$5,000	For Electrical Contracts up to $250,000
2% of Electrical Contract	For Electrical Contracts from $250,000 to $1,500,000
$30,000	For Electrical Contracts over $1,500,000

The project will remain incomplete and no money will be released until the final versions, both hard and electronic, of the drawings and manuals are received.

2.1.3. Final as-built prints/plots shall not contain markings or corrections by hand (i.e. marker, pen, pencil, etc.). References to the Architect and Engineer must be deleted from the drawings.

2.1.4. Final as-built drawings to include all revisions made to the drawings during construction, including all approved change. The as-built drawings are to also include the routing of all feeders except for branch circuits, all junction boxes to be shown, drawing legend to be updated to include all symbols and lines used for as-builts, quantity of wires in each conduit, and circuit numbers of wires in each conduit. Include slab layout drawings in as-built drawing package.

2.1.5. CADD Requirements.

.1 A complete list of layer names and brief description of each layer's use shall accompany all files.

.2 Fonts for text shall be AutoCAD standard. Custom fonts, shape files, etc., are not to be used.

.3 Final as-built drawings shall be returned on CD ROM or DVD.

.4 Each CD ROM shall be clearly labelled with Consultant and Owner, Contract number, file names and Drawing number. If a complete listing exceeds the label size provide a

"readme.txt" file in ASCII format with each CD ROM or DVD. A printed copy of the readme file shall accompany each CD ROM or DVD.

.5 All drawings shall be in the same units as issued on Bid Documents.

.6 Provide a complete list of symbol (block) names with a description of each symbol.

.7 Special effort shall be made to ensure that drafting is accurate: i.e. appropriate lines are indeed horizontal and vertical; lines that should intersect do but not over-intersect and ensure that entities are placed on correct layers.

2.1.6. The Electrical Contractor will maintain two sets of white prints on site on which the Electrical Contractor shall clearly mark, as the job progresses, all changes and deviations from that shown on Contract Drawings. After inspection and approval of service lines in trenches, the Electrical Contractor shall take 'as-built' measurements, including all depths, prior to commencement of backfilling operations. The location of buried electrical ducts and conductors shall be shown on the drawings and dimensioned from fixed points. Drawings shall be kept up-to-date during construction and in addition to field measurements shall include variation orders, field instructions and all other changes.

2.1.7. On completion of the building, the Electrical Contractor shall forward to the Consultant the two sets of final drawings indicating all such changes and deviations for review by the Consultant.

3. Execution

3.1. NOT USED

END OF SECTION 16030

PROJECT NAME: Xxx

ATTENTION: Xxx

PROJECT NO.: Xxx DATE: YYYY-MM-DD ISSUED BY: Xxx

Conditions for Limited Use of CAD Drawings

Authorization for limited use of the Computer-Aided Drafting (CAD) drawing files listed below is hereby granted, subject to the following conditions. Signing of this form constitutes acceptance and agreement with the conditions and limitations.

Copyright is reserved. The drawing and design contained in the CAD drawing file is at all times the exclusive property of the Architect/Engineer and shall not be used without the Architect/Engineer's written consent.

The CAD drawing file may not be used wholly or in part for any purpose other than the intended use as stated on this form. Copying or distribution of this CAD drawing file in whole or in part to parties other than those signing below is not allowed.

The CAD file represents drawings which were prepared primarily for the purpose of obtaining tender prices. The drawings may or may not incorporate subsequent revisions, change orders, or addenda which have modified the drawings. CAD files obtained from different disciplines may not be fully updated and coordinated with other disciplines and must be verified from the tender documents. The Architect/Engineer assumes no liability for errors or omissions in the CAD drawing files. Authorized user assumes all risk and expense associated with the use of the drawing files in the production of his work.

References to the Architect and Engineer must be deleted from the drawings.

Please indicate a P.O. Number for charges associated with administrative costs to provide requested AutoCAD drawings.

Our charges are as follows:	$50.00 each for the first 5 drawings			
	$20.00 for each additional drawing from 6 to 19			
	$500.00 for 20 drawings or more			
List of requested drawings:				
Total No. of Drawings:		Total Charge:		+ GST or HST, as applicable

Intended use (Shop drawings, As-built drawings, Installation and Interference drawings, etc.)

CD ROM disc (please provide delivery address)

E-mail (please provide e-mail address)

A cheque in the above amount shall be payable to **Smith + Andersen**.

Please sign and fax back this form to Smith + Andersen (416-487-9104) acknowledging the above charges and Conditions for Limited Use of CAD Drawings.

Accepted by:

Signature **Name (print or type)**

Company Name **P.O. #**

Company Address **Phone #**

c.c. Accounting - D. Khan; (Project Principal) – Smith + Andersen

1. General

1.1. WORK INCLUDED

1.1.1. Conform to Section 16010 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

2. Products

2.1. SHOP DRAWINGS

2.2. "SECTION 01340" SHALL APPLY EXCEPT AS AMENDED BELOW.

2.2.1. Submittals/Shop Drawings shall indicate clearly the materials and/or equipment actually being supplied, all details of construction, accurate dimensions, capacity, operating characteristics and performance. Each Shop Drawing shall give the identifying number of the specific assembly for which it was prepared (e.g. MCC-1).

2.2.2. Each Shop Drawing for non-catalogue items shall be prepared specifically for this project. Shop Drawings and brochures for catalogue items shall be marked clearly to show the items being supplied.

2.2.3. Each Shop Drawing or catalogue sheet shall be stamped and signed by the Contractor to indicate that he has checked the drawing for conformance with all requirements of the drawings and specifications, that he has co-ordinated this equipment with other equipment to which it is attached and/or connected and that he has verified all dimensions to ensure the proper installation of equipment within the available space and without interference with the work of other trades. Ensure that electrical co-ordination is complete before submitting drawings for review.

2.2.4. Contractor to submit all submittals/shop drawings electronically in PDF format. Submittal to come complete with a transmittal bound to the PDF file with the transmittal identifying the total number of pages in the submittal including the transmittal page. For any submittal with pages larger than 11x17, the Contractor is to submit a minimum of 3 hard copies unless additional copies are identified in the contract documents.

2.2.5. Installation of any equipment shall not start until after final review of Shop Drawings by the Consultant has been obtained.

2.2.6. When requested, Shop Drawings shall be supplemented by data explaining the theory of operation - for example: fire alarm controller - the Consultant may also request that this information be added to the maintenance and operating manual.

2.2.7. Provide space for Shop Drawing review stamps for the Contractor and Consultant. This space shall be clear of all technical information and shall not be on the back of any sheets.

2.2.8. One original Shop Drawing will be returned either hard copy or electronically. All copies required for the trades, suppliers or other Consultants will be copied or printed by the Contractor.

3. Execution

3.1. NOT USED

END OF SECTION 16031

1. General

1.1. WORK INCLUDED

1.1.1. Conform to Section 16010 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

1.1.2. This Section governs requirements for all excavating and backfilling Work required for the installation of buried power and communication services and backfill.

1.1.3. Assume that material to be excavated is earth. When rock is encountered during construction, payment will be made on unit price basis to the extent of net difference in cost between dry earth excavation and solid rock excavation, all as indicated in Contract Documents.

1.2. SUBMITTALS

1.2.1. Provide Shop Drawings indicating proposed method of bedding and backfilling.

2. Products

2.1. SOILS

2.1.1. To the requirements for Granulars “A”, “B” (Type 1), “M” and “Select Subgrade Material”; Ontario Provincial Standard Specifications (OPSS), Form No. 1010 for Granulars “A”, “B”, “M” and “Select Subgrade” material.

2.1.2. Requirements for Pea Gravel: Granular, well-graded clean rounded pea gravel or stone with not more the 2% material that will pass 75 um (No. 200) sieve, maximum 6 mm (1/4 in.), containing not other deleterious material, and subject to testing that specified density can be achieved without compaction.

2.1.3. Requirements for Sand Fill: Uniform quality and unwashed river sand or any clean sand containing less than 5% organic materials, clay or silt (passing 125 um sieve) is acceptable. It can contain a limited amount of small stones or rocks as it comes from the pit. Sharp, clean, coarse sand, water washed, free from clay, salts and organic matter, and in accordance with CSA A179-93 for masonry sand is also acceptable.

3. Execution

3.1. INSTALLATION

3.1.1. All excavation and backfilling for all services shall be in accordance with Division 2.

3.1.2. Protection:

.1 Provide protection to existing structures and services. Be responsible for rectifying any damage to existing structures and services resulting from this operation.

3.1.3. Excavation in Soil:

.1 Excavation carried below the correct inverts shall be backfilled with 2000 psi (13.5 mPa) concrete to the underside of the pipe lines, unless otherwise directed in writing.

3.1.4. Excavation in rock:

.1 All excavation in rock is included under separate Section, (the Site Work Division (Section 02200 – EXCAVATION/EARTHWORKS)) and is taken to a minimum of 150 mm (6 in.) below the correct pipe invert. This Division shall use a bedding material to the correct trench invert.

3.1.5. Backfilling

.1 Backfill with sand from the bottom of the trench or excavation up to a point 300 mm (12 in.) above the top of service line or appurtenance.

.2 Backfill duct trenches with sand to a depth 300 mm (12 in.) above the ducts. The sand shall be thoroughly tamped around and over the pipes in 150 mm (6 in.) layers.

.3 Backfill the remainder of trench or excavation up to top of subgrade or bottom of floor slabs ongrade.

END OF SECTION 16051

1. General

1.1. WORK INCLUDED

1.1.1. Conform to Section 16010 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

2. Products

2.1. MATERIALS

2.1.1. Sleeves passing through stud partitions shall be 0.75 mm (1/32 in.) 22 US Gauge steel.

2.1.2. Sleeves passing through masonry walls shall be Schedule 40 steel pipe.

2.1.3. Sleeves passing through floors in finished areas and concealed spaces may be sheet metal or factory fabricated reusable type.

2.1.4. Sleeves passing through floors in electrical rooms, mechanical rooms, garages or other similar rooms in all areas except slab on grade, shall extend 50 mm (2 in.) above the housekeeping pad and shall be Schedule 40 steel pipe.

2.1.5. Where a housekeeping pad cannot be installed, sleeves passing through floors with waterproof membrane shall have a flashing collar, 50 mm (2 in.) wide at the membrane level. Flashing collar shall be continuously welded to sleeve. Sleeves shall extend 50 mm (2 in.) above the finished floor and shall be Schedule 40 steel pipe.

2.1.6. Where conduits pass through exterior foundation walls 6 mm (1/4 in.) thick steel sleeve of inside diameter not less the 75 mm (3 in.) greater than the outside diameter of the pipe shall be used and shall be complete with anchor collar. Thunderline Link-Seal wall seal as distributed by Corrosion Service Co. Ltd. shall be used for the annular space between the sleeve and the conduit. A reinforced concrete bridge shall be installed between the wall and the adjacent undisturbed soil.

2.1.7. Provide adequate bracing for support of sleeves during concrete and masonry work.

3. Execution

3.1. INSTALLATION

3.1.1. Arrange for all chases and formed openings in walls and floors as required by the Electrical Division for the Electrical services. These chases and openings shall not be larger than necessary to accommodate the equipment and services. Advise on these requirements well in advance, before the concrete is poured and the walls are built. All necessary sleeves and inserts shall be supplied by this Division.

3.1.2. Chases and openings not located in accordance with the above provisions shall be made at the expense of this Division. Cutting of structural members shall not be permitted without specified written acceptance of the Consultant.

3.1.3. Provide sleeves for all service penetrations through walls, partitions, floor slabs, plenums and similar barriers. At non-rated barriers fill the annular space between the service and the sleeve with fire rated insulation as specified for rated separations and caulk around the edges with a minimum 12 mm (1/2 in.) thick of fire rated compound or acoustic non-setting mastic.

3.1.4. Through all fire or smoke separations, after testing, the annular space between conduit sleeves shall be fire stopped.

3.1.5. Where holes are to be installed in existing structure, contractor is to core drill the holes required. Contractor is required to scan all areas prior to coring and confirm layout with structural engineer prior to completing work. When installing sleeves in existing structures, sleeves shall be provided as specified complete with a combination puddle/anchor flange bolted to the floor. Seal watertight between the flange and the floor.

3.1.6. All sleeves are to extend 100mm (4”) above finished floor to accommodate a 100mm (4”) concrete pad. Contractor to pour the concrete pad with the pad extending 100mm on all sides of the sleeve.

END OF SECTION 16052

1. General

1.1. WORK INCLUDED

1.1.1. Conform to Section 16010 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

2. Products

2.1. EQUIPMENT IDENTIFICATION

2.1.1. Identify electrical equipment with nameplates and labels as follows:

.1 Nameplates:

.1 Lamacoid 3 mm (1/8 in.) thick plastic engraved sheet, black or red face, white core, mechanically attached with self tapping screws.

.2 White letters 20 mm (3/4 in.) high for major switchboards, panelboards and power transformers.

.3 White letters 12 mm (1/2 in.) high for terminal boxes, junction boxes, grid boxes, splitter boxes, disconnect switches starters and contactors.

.4 Allow for an average of twenty-five (25) letters per nameplate.

.5 Identification to be in English.

.6 Black nameplates for normal power.

.7 Red nameplates for emergency power.

.8 Blue nameplates for UPS Power.

Sample:

SWITCHBOARD AA

3000A, 600/347V, 3 PH 4W

FED FROM SWITCHBOARD AAA

.2 Labels:

.1 Embossed plastic labels with 6 mm (1/4 in.) high letters unless specified otherwise, for internal components, such as relays, fuses, terminal blocks.

.2 Wording on nameplates to be approved by Consultant prior to manufacture.

.3 Identification to be in English.

.4 Nameplates for terminal cabinets, grid boxes pull boxes, and junction boxes are to indicate the system and/or voltage characteristics.

.5 Disconnects, starters and contactors: indicate equipment being controlled and voltage.

.6 Transformers: indicate capacity, primary and secondary voltages.

2.1.2. Equipment identification to be permanently fastened to the respective equipment with rivets.

2.2. WIRING IDENTIFICATION

2.2.1. Identify wiring with permanent legible identifying markings, either numbered or coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.

2.2.2. Maintain phase sequence and colour coding throughout.

2.2.3. Colour code: to CSA C22.1-1998.

2.2.4. Use colour coded wires in communication cables and control wiring, matched throughout system.

2.3. CONDUIT AND CABLE IDENTIFICATION

2.3.1. Colour code conduits, boxes and metallic sheathed cables.

2.3.2. Code with plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor, and at 15 m (50 foot) intervals.

2.3.3. Colours: 25 mm (1 in.) wide prime colour and 20 mm (3/4 in.) wide auxiliary colour.

	Colour
up to 250 V Normal Power	Green
up to 600 V Normal Power	Blue
up to 250 V Emergency Power	Black
up to 600 V Emergency Power	Orange
Medium Voltage	Large independent label clearly identifying the votlage
Telephone/Data	White
Fire alarm	Red
Other security systems	Yellow
Controls	Purple

2.4. RECEPTACLE IDENTIFICATION

2.4.1. All receptacles are to be labelled with the respective circuit numbers with a printed label, similar to a Brady label, with 12mm characters. Circuit number to include full circuit number including panel board identification.

2.4.2. Label to be placed on wall above cover plate or on cover plate. Location of label to be consistent throughout project.

2.5. WIRING TERMINATION

2.5.1. Lugs, terminals, screws used for termination of wiring to be suitable for either copper or aluminum conductors.

2.5.2. Lugs, terminals, screws used for termination of multiple wires must be rated for their intended use.

2.6. MANUFACTURERS AND CSA LABELS

2.6.1. Visible and legible after equipment is installed.

2.7. WARNING SIGNS

2.7.1. Provide warning signs, as specified, and/or to meet the requirements of the Inspection Authorities.

2.8. FUSE SIZE LABELLING

2.8.1. Contractor to install a label on all equipment with fuses to identify the fuse sizes that are installed in the respective equipment.

2.8.2. Contractor to also install a label on all equipment with fuses to identify the maximum allowable fuse size based on the size of the respective feeders.

3. Execution

3.1. NOT USED

END OF SECTION 16056

1. General

1.1. WORK INCLUDED

1.1.1. Conform to Section 16010 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

2. Products

2.1. MOUNTING HEIGHTS

2.1.1. Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise.

2.1.2. If mounting height of equipment is not specified or indicated, verify before proceeding with installation.

2.1.3. Install electrical equipment at following heights unless indicated otherwise.

- .1 Local switches: 1200 mm (48 in.).
- .2 Wall receptacles:
  - .1 General: 450 mm (18 in.).
  - .2 Above top of continuous baseboard heater: 200 mm (8 in.).
  - .3 Above top of counters or counter splash backs: 175 mm (7 in.).
  - .4 In mechanical rooms: 1200 mm (48 in.).
- .3 Panelboards: 2000 mm (80 in.) to top of panel.
- .4 Telephone and interphone outlets: 450 mm (18 in.).
- .5 Wall mounted telephone and interphone outlets: 1200 mm (48 in.).
- .6 Fire alarm stations: 1200 mm (48 in.).
- .7 Wall Mounted Fire alarm bells: 2300 mm (90 in.).
- .8 Television outlets: 450 mm (18 in.).
- .9 Clocks: 2100 mm (83 in.).
- .10 Handicap pushbuttons: 1100 mm (43 in.).
- .11 Wall mounted Exit Signs
  - .1 For 2400 mm (95 in.) to 2500 mm (100 in.) ceiling areas: 2100 mm (83 in.).
  - .2 For all ceilings greater than 2500 mm (100 in.) ceiling areas: 2400 mm (95 in.).
- .12 Wall mounted Battery Packs and Emergency Heads
  - .1 For 2400 mm (95 in.) to 2500 mm (100 in.) ceiling areas: 2100 mm (83 in.).
  - .2 For all ceilings greater than 2500 mm (100 in.) ceiling areas: 2400 mm (95 in.).
- .13 Wall mounted occupancy sensors: 1200 mm (48 in.).

.14 Wall mounted visible signal devices: entire lens shall be no less than 2000 mm (79 in.) and no more than 2400 mm (95 in.)

3. Execution

3.1. NOT USED

END OF SECTION 16057

1. General

1.1. WORK INCLUDED

1.1.1. Conform to Section 16010 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS and DIVISION 1.

1.2. DESCRIPTION

1.2.1. Submit drawings showing size, type and location of all access doors, for review, before installation.

2. Products

2.1. MATERIALS

2.1.1. Access doors shall be Acudor, or Le Hage.

2.1.2. Doors in solid walls shall be equal to Acudor Model UF5000 with 14 U.S. gauge, prime painted steel door panel, rust resistant concealed hinges and screwdriver operated lock.

2.1.3. Doors in plaster or drywall partitions or ceiling shall be equal to Acudor model AP5010 for plaster or DW 5040 for drywall, 16 US gauge, prime painted steel, concealed hinges and screwdriver operated lock.

2.1.4. Access doors in fire rated walls or ceilings shall be equal to Acudor Model FW 5050 and ULC labeled with insulated door panel, concealed hinge, self closing, self latching, prime painted. Provide master key operated catch in areas accessible to the public.

2.1.5. All doors in tiled walls shall be 16 US gauge, stainless steel, type 304 with #4 satin finish, concealed hinges, wall frame and screw driver operated lock.

2.1.6. Minimum size of doors shall be 300 mm x 450 mm (12 in. x 18 in.). Wherever possible 600 mm x 600 mm (24 in. x 24 in.) doors shall be used.

3. Execution

3.1. INSTALLATION

3.1.1. All parts of the installation requiring periodic maintenance shall be accessible. Wherever pull boxes, junction boxes and other appurtenances are concealed by building construction, access doors shall be furnished by this section and installed under the respective Trade Sections (i.e. masonry, plaster, drywall, tile, etc.) This section is responsible for the proper location of the access doors.

3.1.2. Wherever possible, items requiring access shall be located in easily accessible areas (i.e. exposed or T-bar ceilings).

3.1.3. Group items in order to minimize the number of access doors required.

3.1.4. Each access door shall be installed to provide complete access to equipment for maintenance and servicing.

3.1.5. Make any changes to locations of access doors as directed by the Consultant.

3.1.6. The final installed locations of all access doors shall be shown on the As-Built Record Drawings.

END OF SECTION 16060

1. General

1.1. WORK INCLUDED

1.1.1. Conform to Section 16010 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

1.1.2. Comply with all requirements of Section 16030 – RECORD DRAWINGS.

1.1.3. Comply with all requirements of Section 16031 – SHOP DRAWINGS.

2. Products

2.1. NOT USED

3. Execution

3.1. REQUIREMENTS FOR MANUALS

3.1.1. A minimum of three copies of complete and approved operating and maintenance instructions for all electrical equipment and systems shall be supplied before substantial completion. Provide additional copies if required under the General Requirements. In addition to the three copies of manuals, the contractor to provide a manual in a searchable PDF format on CD. As-Built Drawings to be included on the CD.

3.1.2. The contractor to identify the cost of Record Drawings and the Operation and Maintenance Manuals as a separate line item on their progress draw. The values to be broken out can be found in Section 16030 – Record Drawings. The project will remain incomplete and no money will be released until the final versions, both hard and electronic, of the drawings and manuals are received and reviewed without comments.

3.1.3. Binders shall be three-ring, hard-cover, loose-leaf type and identified on the binding edges as “Maintenance Instructions and Data Book”, for “Cedarvale Public School - Expansion”.

3.1.4. Terminology used in all the sections shall be consistent.

3.1.5. Volume One shall contain the master index of all systems, the name of the Contractor, Electrical Subcontractors and the date of substantial performance for the Contract.

3.1.6. Volume One shall contain a section with all necessary warranty information.

3.1.7. Each binder shall have a complete index for all volumes.

3.1.8. Each binder shall be no more than half filled.

3.1.9. There shall be a separate section for all materials used on the project which fall under the WHMIS legislation. There shall be a hazard data sheet for each of the materials.

3.1.10. There shall be a separate section for all Insurance Certificates, Test Certificates, Verification Forms and Test Forms.

3.1.11. All relevant information relating to a system or product shall be contained within one binder.

3.1.12. The manual sections shall follow the specification sections.

3.1.13. Any diagrams, installation drawings, single line diagrams charts, etc. shall be mechanically reduced while maintaining full legibility to standard page size. If this cannot be achieved they shall be carefully folded and contained within a clear plastic wallet within the manual.

3.2. DATA FOR MANUALS

3.2.1. Equipment data shall contain:

.1 Operating instructions.

.2 Operating conditions such as temperature and pressure.

.3 Location of equipment.

.4 Maintenance instructions and schedules for one year routine.

.5 Recommended list of spare parts.

.6 Maintenance schedule.

.7 A trouble shooting table showing where to look for problems under various conditions of malfunction.

.8 All wiring diagrams.

.9 Equipment operating curves.

.10 Equipment nameplate data and serial numbers.

3.2.2. System data shall contain:

.1 A listing of all systems.

.2 All panel, mcc and fire alarm schedules and locations.

.3 Equipment name tags.

.4 Cleaning, maintaining and preserving instructions for all material, products and surfaces. Include warnings of harmful cleaning, maintaining and preserving practices.

3.2.3. Sub-Contractor manuals are required for:

.1 Switchboards and power distribution systems.

.2 Lighting systems.

.3 Emergency power systems.

.4 Fire alarm systems.

3.2.4. As-Built documentation shall contain:

.1 Reviewed As-Built Shop Drawings.

.2 As-Built Construction Drawings.

.3 Originals of test forms.

.4 Originals of test certificates.

3.3. OPERATING INSTRUCTIONS

3.3.1. Instruct the Owner's representative in all aspects of the operation and maintenance of systems and equipment.

3.3.2. Instruct the Owner for a minimum of five (5) working days.

3.3.3. All instruction sessions to be video-taped and copy must be provided to the consultant/owner.

3.3.4. Arrange for and pay for the services of engineers and other manufacturers representatives required for instruction on the systems and the equipment as requested by the Consultant and/or the Owner.

3.3.5. At the time of final inspection, provide a sheet for each system and piece of equipment showing the date instructions were given. Each sheet shall show the duration of instruction, name of persons receiving instruction, other persons present (manufacturer's representative, Consultant, etc.), system or equipment involved and signature of the Owner's staff stating that they understood the system installation, operating and maintenance requirements. This information shall be inserted in the manuals after all instructions have been completed.

3.3.6. Review information with the Owner's representative to ensure that all information required has been provided.

3.3.7. Electrical equipment and systems included in the instruction requirements are:

.1 Switchboards and related power distribution equipment.

.2 Fire alarm systems.

3.4. TRIAL USAGE

3.4.1. The Owner shall be permitted trial usage of systems or parts of systems for the purpose of testing and learning operational procedures. Trial usage shall not affect the warranties nor be construed as acceptance, and no claim for damage shall be made against the Owner for any injury or breakage to any part or parts due to the tests, where such injuries or breakage are caused by a weakness or inadequacy of parts, or by defective materials or workmanship of any kind.

END OF SECTION 16061

1. General

1.1. WORK INCLUDED

1.1.1. Conform to Section 16010 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

1.1.2. Include for all cutting and patching for all Electrical services.

2. Products

2.1. MATERIALS

2.1.1. All services and materials used for the cutting and patching shall meet all requirements specified in Section 01040, and shall be carried out by experienced workers.

3. Execution

3.1. INSTALLATION

3.1.1. Cut all openings no larger than is required for the services. Core drill for individual services.

3.1.2. Obtain approval from the structural consultant before cutting or core drilling any openings or holes.

3.1.3. Patch all openings after services have been installed to match the surrounding finishes.

3.1.4. In existing areas all cutting, except for core drilling for individual services or where specifically noted, is part of this division work.

3.1.5. The cost of cutting, patching and finishing is included in this division contract.

END OF SECTION 16080

1. General

1.1. WORK INCLUDED

1.1.1. Conform to Section 16010 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

1.2. PRODUCT DATA

1.2.1. Conduit and equipment provided under the Electrical division shall be complete with all necessary supports and hangers required for a safe and workmanlike installation.

2. Products

2.1. MATERIALS

2.1.1. Provide “U” type support Strut as manufactures by Unistrut.

3. Execution

3.1. INSTALLATION

3.1.1. The Contractor to supply anchor bolts and base diagrams of equipment showing exact location for anchor bolts.

3.1.2. It shall be the responsibility of the mechanical division to supply the Contractor with anchor bolts and base diagrams of equipment showing exact location of anchor bolts.

3.1.3. All drilling for hangers, rod inserts and work of similar nature shall be done by this Division.

3.1.4. Auxiliary structural members shall be provided under the electrical section concerned where conduits or equipment must be suspended between the joists or beams of the structure, or where required to replace individual hanger to allow for installation on new services. Submit details for review as requested.

3.1.5. Depending on type of structure, hangers shall be either clamped to steel beams or joists, or attached to approved concrete inserts.

3.1.6. Approved type expansion shields and bolts may be used for conduit up to 100 mm (4 in.) diameter where the presetting of concrete inserts is not practical. Submit Shop Drawings.

3.1.7. Suspension from metal deck shall not be allowed unless specifically accepted by the Consultant. Drawings of the proposed method of suspension must be submitted for review.

3.1.8. Suspending one hanger from another shall not be permitted.

3.1.9. All hangers, supports, brackets and other devices used outside the building wall shall be galvanized. If galvanized components cannot be used submit samples of proposed substituted for review before installation.

END OF SECTION 16094

1. General

1.1. WORK INCLUDED

1.1.1. Conform to Section 16010 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

1.2. REFERENCES

1.2.1. Canadian Standards Association (CSA)

.1 CAN/CSA-A5-93, Portland Cement.

.2 CSA-A23.1-94, Concrete Materials and Methods of Concrete Construction.

.3 CSA G30.3-M1983 (R1991), Cold-Drawn Steel Wire for Concrete Reinforcement.

.4 CSA G30.5-M1983 (R1991), Welded Steel Wire Fabric for Concrete Reinforcement.

.5 CSA G30.18-92, Billet-Steel Bars for Concrete Reinforcement.

1.2.2. American Society for Testing and Materials (ASTM)

.1 ASTM D 1056-91, Specification for Flexible Cellular Materials - Sponge or Expanded Rubber.

1.3. SHOP DRAWINGS

1.3.1. Submit Shop Drawings in accordance with 16031 – SHOP DRAWINGS.

1.3.2. Submit Shop Drawings for precast maintenance chambers.

1.3.3. Submit Shop Drawings for ground rod details for cable rack grounding.

2. Products

2.1. PVC DUCTS

2.1.1. PVC ducts, type EB1, encased in reinforced concrete.

2.2. PVC DUCT FITTINGS

2.2.1. Rigid PVC opaque solvent welded type couplings, bell end fittings, plugs, caps, adaptors as required to make complete installation.

2.2.2. Expansion joints.

2.2.3. Rigid PVC 5 degree angle couplings.

2.3. PRECAST CONCRETE MAINTENANCE CHAMBERS

2.3.1. Precast concrete maintenance chambers and auxiliary sections shall be fabricated in steel forms.

2.3.2. Aggregates: to CSA-A23.1.

2.3.3. Cement: to CAN/CSA-A5, Type 30.

2.3.4. Steel welded wire fabric mesh reinforcing: to CSA G30.3.

2.3.5. Pulling inserts and bolts for racks integrally cast in concrete.

2.3.6. Neoprene gasket seals between maintenance chamber sections: to ASTM D 1056.

2.3.7. Precast concrete maintenance chambers to come complete with a well in the bottom of the maintenance chamber with a breakout section in the bottom to allow for natural drainage. Well to be used for sump pump where one is identified on the drawings.

2.3.8. Precast concrete maintenance chambers to come complete with concrete knockout duct sections in each wall of the duct bank. Provide a minimum of 18 duct knockouts on each face of the maintenance chamber. Provide additional knockouts as required to suit the contract documents. Rebar is only to encircle all the duct knockouts and no rebar is to be run between duct knockouts.

2.4. DRAINAGE

2.4.1. Provide floor drain fittings in maintenance chamber consisting of floor drain, back water valve, trap and pipe connection to drainage system.

2.4.2. Provide a storm sewer connection: cast iron service saddle consisting of oil resistant gasket, stainless steel clamp and oil resistant O-ring.

2.4.3. Provide a sump pit with dimensions of 300 x 300 x 125 mm (1 ft x 1 ft x 5 in.).

2.5. MAINTENANCE CHAMBER NECKS

2.5.1. Shall be constructed of concrete brick and mortar.

2.6. MAINTENANCE CHAMBER FRAMES AND COVERS

2.6.1. Provide cast iron maintenance chamber frames and covers.

2.6.2. Provide bolted on covers to prevent unauthorized entry.

2.7. GROUNDING

2.7.1. Ground rods: Provide ground rod detail, as indicated for cable rack grounding.

2.8. CABLE RACKS

2.8.1. Hot dipped galvanized cable racks and supports.

2.8.2. Cable racks to be a minimum of 300mm deep with a universal clamping means to secure the cable to the cable rack.

2.8.3. Provide all required hardware and supports to allow for the installation of the cable racks.

2.9. CABLE PULLING EQUIPMENT

2.9.1. Pulling iron: galvanized steel rods, size and shape as indicated.

2.9.2. Pull rope: 6 mm (0.2 in.) stranded polypropylene, tensile strength 5 kN, continuous throughout each duct run with 3 m (10 ft.) spare rope at each end.

2.10. MARKER TAPE

2.10.1. Use of red plastic marker tape with black letters “DANGER – HIGH VOLTAGE” identifying the underground electrical installation. .

3. Execution

3.1. INSTALLATION GENERAL

3.1.1. Install underground duct banks and maintenance chambers including formwork.

3.1.2. Build duct bank and maintenance chambers on undisturbed soil or on well compacted granular fill not less than 150 mm (6 in.) thick, compacted to 95% of maximum proctor dry density.

3.1.3. Open trench completely between connected maintenance chambers before ducts are laid and ensure that no obstructions will necessitate change in grade of ducts.

3.1.4. Prior to laying ducts, construct "mud slab" not less than 75 mm (3 in.) thick.

3.1.5. Install ducts at elevations and with slope as indicated and minimum slope of 1 to 400.

3.1.6. Install base spacers at maximum intervals of 1.5 m (5 ft.) leveled to grades indicated for bottom layer of ducts.

3.1.7. Lay PVC ducts with configuration and reinforcing as indicated with preformed interlocking, rigid plastic intermediate spacers to maintain spacing between ducts at not less than 40 mm (1.5 in.) horizontally and vertically. Stagger joints in adjacent layers at least 150 mm (6 in.) and make joints watertight. Encase duct bank with 75 mm (3 in.) thick concrete cover. Use galvanized steel conduit for sections extending above finished grade level.

3.1.8. Make transpositions, offsets and changes in direction using angle sections.

3.1.9. Use bell ends at duct terminations in maintenance chambers or buildings.

3.1.10. Use conduit to duct adapters when connecting to conduits.

3.1.11. Terminate duct runs with duct coupling set flush with end of concrete envelope when dead ending duct bank for future extension.

3.1.12. Cut, ream and taper end of ducts in field in accordance with manufacturer's recommendations, so that duct ends are fully equal to factory-made ends.

3.1.13. Allow concrete to attain 50% of its specified strength before backfilling.

3.1.14. Use anchors, ties and trench jacks as required to secure ducts and prevent moving during placing of concrete. Tie ducts to spacers with twine or other non-metallic material. Remove weights or wood braces before concrete has set and fill voids.

3.1.15. Clean ducts before laying. Cap ends of ducts during construction and after installation to prevent entrance of foreign materials.

3.1.16. Install a minimum of four 3 m (1 ft.) lengths of 15 mm (9/16 in.) reinforcing rods, one in each corner of duct bank when connecting duct to maintenance chambers or buildings. Wire rods to 15 mm (19/32 in.) dowels at maintenance chamber or building and support from duct spacers. Protect existing cables and equipment when breaking into existing maintenance chambers. Place concrete down sides of duct bank filling space under and around ducts. Rod concrete with flat bar between vertical rows filling voids.

3.1.17. Immediately after placing of concrete, pull through each duct a steel mandrel not less than 300 mm (1 ft.) long and of a diameter 6 mm (1/4 in.) less than internal diameter of duct, followed by stiff bristle brush to remove sand, earth and other foreign matter. Avoid disturbing or damaging ducts where concrete has not set completely. Pull stiff bristle brush through each duct immediately before pulling-in cables.

3.1.18. Install a polypropylene pull string in each duct. Secure the pull string at each end of the duct.

3.1.19. Install red “DANGER – HIGH VOLTAGE” warning tape across the entire width of the ductbank in the soil half way between the duct bank and grade.

3.1.20. Mark location of duct runs under hard surfaced areas not terminating in maintenance chamber with railway spike driven flush in edge of pavement, directly over run.

3.1.21. Where markers are removed to permit installation of additional duct, reinstall existing markers.

3.1.22. Provide As-Built Drawings showing locations of markers.

3.2. MAINTENANCE CHAMBERS

3.2.1. Install precast maintenance chambers.

3.2.2. Provide 115 mm (4½ in.) deep window to facilitate cable bends in wall at each duct connection. Terminate ducts in bell-end fitting flush with window face. Provide four 10 mm (3/8 in.) steel dowels at each duct run connection to anchor duct run. On runs of 16 ducts and over, support concrete duct encasement on a 700 mm (2 ft. - 3½ in.) wide by 75 mm (3 in.) thick concrete pier poured against maintenance chamber wall between slab and bottom of duct run, provide dowels for anchoring.

3.2.3. Alternately connect large duct runs by leaving square opening in wall, later pouring duct run and wall opening in one pour, and install 10 mm (3/8 in.) x 3 m (10 ft.) reinforcing rods in duct run at maintenance chamber connection.

3.2.4. Build up concrete maintenance chamber neck to bring cover flush with finished grade in paved areas and 40 mm (1½ in.) above grade in unpaved areas.

3.2.5. Install maintenance chamber frames and covers for each chamber. Set frames in concrete grout onto chamber neck.

3.2.6. Drain floor towards sump with 1 to 48 slope minimum and install drainage fittings as indicated.

3.2.7. Install cable racks, anchor bolts and pulling irons as indicated.

3.2.8. Grout frames of maintenance chambers. Cement grout to consist of two parts sand and one part cement and sufficient water to form a plastic like slurry.

3.2.9. Ensure filling of voids in joint being sealed. Plaster with cement grout the walls, ceiling and neck.

3.2.10. Spray paint an "X" on ceiling of maintenance chamber above floor drain or sump pit.

3.3. INSPECTIONS

3.3.1. Inspection of duct and duct clean out will be witnessed by the Consultant prior to placement of concrete.

END OF SECTION 16105

1. General

1.1. WORK INCLUDED

1.1.1. Conform to Section 16010 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

1.2. DESCRIPTION OF SYSTEM

1.2.1. Perform excavation and backfill work, in accordance with Section 02315 (the Site Work Division (Section 02200 – EXCAVATION/EARTHWORKS)). Co-ordinate scope of work with Section 02315 (the Site Work Division (Section 02200 – EXCAVATION/EARTHWORKS)).

2. Products

2.1. CABLE PROTECTION

2.1.1. Protect existing cables in manholes and trenches with 38 mm x 140 mm (1½ in. x 5½ in.) planks pressure treated with 5% pentachlorophenol solution, water repellent preservative.

2.2. MARKERS

2.2.1. Concrete type cable markers: 600 x 600 x 100 mm (2 ft. x 2 ft. x 4 in.) with words: cable, joint or conduit impressed in top surface, with arrows to indicate change in direction of cable and duct runs.

3. Execution

3.1. CABLE INSTALLATION IN DUCTS

3.1.1. Install cables as indicated in ducts.

3.1.2. Pull a steel mandrel through each duct less than 300 mm (1 ft.) long and of a diameter 6 mm (1/4 in.) less than internal diameter of duct, followed by stiff bristle brush to remove sand, earth and other foreign matter. Pull stiff bristle brush through each duct immediately before pulling-in cables.

3.1.3. Install a polypropylene pull string in each duct if one does not exist. Pull string to remain after cable has been installed.

3.1.4. Do not pull spliced cables inside ducts.

3.1.5. Install multiple cables in duct simultaneously.

3.1.6. Use CSA approved lubricants of type compatible with cable jacket to reduce pulling tension.

3.1.7. To facilitate matching of colour coded multiconductor control cables reel off in same direction during installation.

3.1.8. Before pulling cable into ducts and until cables are properly terminated, seal ends of lead covered cables with wiping solder; seal ends of non-leaded cables with moisture seal tape.

3.1.9. After installation of cables, seal duct ends with duct sealing compound.

3.2. MARKERS

3.2.1. Mark cable every 150 m (492 ft.) along cable or duct runs and changes in direction.

3.2.2. Mark underground splices.

3.2.3. Where markers are removed to permit installation of additional cables, reinstall existing markers.

3.2.4. Lay concrete markers flat and centered over cable with top flush with finish grade.

3.3. FIELD QUALITY CONTROL

3.3.1. Perform tests in accordance with Section 16010 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

3.3.2. Perform tests in accordance with Section 16025 – TECHNICAL SERVICES DIVISION START-UP SERVICES.

END OF SECTION 16106

1. General

1.1. WORK INCLUDED

1.1.1. Section 16010 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

1.1.2. Section 16131 - SPLITTERS, JUNCTION, PULL BOXES AND CABINETS

1.1.3. Section 16132 - OUTLET BOXES, CONDUIT BOXES AND FITTINGS

1.2. REFERENCES

1.2.1. Canadian Standards Association (CSA)

.1 CAN/CSA C22.2 No.18- Outlet Boxes, Conduit Boxes, and Fittings.

.2 CSA C22.2 No.45- Rigid Metal Conduit.

.3 CSA C22.2 No.56- Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.

.4 CSA C22.2 No.83- Electrical Metallic Tubing.

.5 CSA C22.2 No.211.2- Rigid PVC (Unplasticized) Conduit.

.6 CAN/CSA C22.2 No.227.3- Flexible Nonmetallic Tubing.

.7 CSA C22.2 No.227.1 - Electrical Non-Metallic Tubing

2. Products

2.1. CONDUITS

2.1.1. Rigid metal conduit: to CSA C22.2 No.45, galvanized steel or aluminum threaded.

2.1.2. Epoxy coated conduit: to CSA C22.2 No.45, with zinc coating and corrosion resistant epoxy finish inside and outside.

2.1.3. Electrical metallic tubing (EMT): to CSA C22.2 No.83, with couplings.

2.1.4. Rigid PVC conduit: to CSA C22.2 No.211.2.

2.1.5. Flexible metal conduit: to CSA C22.2 No.56, steel or liquid-tight flexible metal.

2.1.6. Electrical non-metallic tubing (ENT): to CSA C 22.2 No. 227, with couplings.

2.2. CONDUIT FASTENINGS

2.2.1. One hole steel straps to secure surface conduits NPS 2 and smaller. Two hole steel straps for conduits larger than NPS 2.

2.2.2. Beam clamps to secure conduits to exposed steel work.

2.2.3. Channel type supports for two or more conduits at 1 m oc.

2.2.4. Hot dipped galvanized threaded rods, 6 mm (1/4 in.) dia. minimum, to support suspended channels.

2.3. CONDUIT FITTINGS

2.3.1. Fittings: manufactured for use with conduit specified. Coating: same as conduit.

2.3.2. Factory "ells" where 90 bends are required for 1” and larger conduits when a hydraulic bender is not used.

2.3.3. Connectors, couplings and straps for EMT conduit are to be set-screw steel type. In a sprinklered environment, provide watertight fittings and “O” rings on all vertical conduit runs or when conduit is terminated at any piece of electrical equipment.

2.3.4. Provide plastic bushings for all connectors, rigid nipples and rigid conduit 1-1/4” or larger.

2.4. EXPANSION FITTINGS FOR RIGID CONDUIT

2.4.1. Watertight expansion fittings with integral bonding jumper suitable for linear expansion and 19 mm (3/4 in.) deflection in all directions.

2.5. FISH CORD

2.5.1. Fish cord to be made of polypropylene.

3. Execution

3.1. INSTALLATION

3.1.1. Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.

3.1.2. Conceal conduits except in mechanical and electrical service rooms or in unfinished areas. Conduits to have their own support system and are to be supported independently of the ceiling grid or ceiling support system.

3.1.3. Where vertically run conduit passes through a slab, Contractor to provide a 100mm (4”) high concrete pad with the pad extending 100mm on all sides of the conduit.

3.1.4. Use electrical metallic tubing (EMT) conduit except where specified otherwise.

3.1.5. Use epoxy coated conduit in corrosive areas.

3.1.6. Use rigid galvanized steel threaded conduit where conduit is subject to mechanical injury.

3.1.7. Use rigid PVC conduit underground or in corrosive areas and where indicated.

3.1.8. Use flexible metal conduit for connection to motors or vibrating equipment in dry areas, connection to recessed incandescent fixtures without a prewired outlet box, connection to surface or recessed fluorescent fixtures and work in movable metal partitions.

3.1.9. Use liquid tight flexible metal conduit for connection to motors or vibrating equipment in damp, wet or corrosive locations. Use only liquid tight fittings when using liquid tight flexible metal conduit. Liquid tight flexible metal conduit to have a jacket with an FT6 rating when used in plenums otherwise provide a minimum FT4 rating.

3.1.10. Use explosion proof flexible connection for connection to explosion proof motors.

3.1.11. Install conduit sealing fittings in hazardous areas. Fill with compound.

3.1.12. Minimum conduit size for lighting and power circuits: NPS 21mm (3/4”).

3.1.13. Install EMT conduit from a raised floor branch circuit panel to outlet boxes located in sub floor.

3.1.14. Install EMT conduit from a raised floor branch circuit panel to junction box in sub-floor. Run flexible metal conduit from junction box to outlet boxes for equipment connections in sub-floor.

3.1.15. Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.

3.1.16. Mechanically bend steel conduit over 19 mm (3/4 in.) dia.

3.1.17. Field threads on rigid conduit must be of sufficient length to draw conduits up tight.

3.1.18. Install fish cord in empty conduits.

3.1.19. Run two 27mm (1”) spare conduits up to ceiling space and two 27mm (1”) spare conduits down to sub-floor space from each flush panel. Terminate these conduits in 152 x 152 x 102 mm (6 in. x 6 in. x 4 in.) junction boxes or in case of an exposed concrete slab, terminate each conduit in flush concrete or surface type box.

3.1.20. Remove and replace blocked conduit sections. Do not use liquids to clean out conduits.

3.1.21. Dry conduits out before installing wire.

3.1.22. All cutting and patching of masonry/concrete floors, walls, and roof for electrical services shall be by this Division. Obtain approval from the Landlord and/or structural consultant before cutting any structural walls or floors. Cutting and drilling shall only be at times allowed by the Landlord. Check and verify the location of existing mechanical and electrical services in walls and below the floor slab in all areas requiring core drilling and cutting. Protect all tenant areas where core drilling occurs. Carefully chip top and bottom of slab to expose rebars to minimize cutting of rebars when core drilling. Provide x-ray study before drilling or cutting where required by the Landlord and/or structural consultant.

3.1.23. Provide sleeves for all new conduits passing through floor and roof slabs, beams, concrete walls and slab to slab partitions, etc.

3.1.24. Where cables and conduits pass through partitions and through floors that are not fire rated, provide an air-tight seal around the cables and conduits.

3.1.25. Where cables and conduits pass through floors and fire rated walls, pack space between conduit (or cable) and sleeve with an approved fire stop as specified in Section 16010 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

3.2. SURFACE CONDUITS

3.2.1. Run parallel or perpendicular to building lines.

3.2.2. Locate conduits behind infrared or gas fired heaters with 1.5 m (5 ft.) clearance.

3.2.3. Run conduits in flanged portion of structural steel.

3.2.4. Group conduits wherever possible on suspended or surface mounted channels.

3.2.5. Do not pass conduits through structural members, except as indicated.

3.2.6. Do not locate conduits less than 75 mm (3 in.) parallel to steam or hot water lines with minimum of 25 mm (1 in.) at crossovers.

3.2.7. Conduits must not be used to support other conduits.

3.3. CONCEALED CONDUITS

3.3.1. Run parallel or perpendicular to building lines.

3.3.2. Do not install horizontal runs in masonry walls.

3.3.3. Do not install conduits in terrazzo or concrete toppings.

3.4. CONDUITS IN CAST-IN-PLACE CONCRETE

3.4.1. Locate to suit reinforcing steel. Install in centre one third of slab.

3.4.2. Protect conduits from damage where they stub out of concrete.

3.4.3. Install sleeves where conduits pass through slab or wall.

3.4.4. Provide oversized sleeve for conduits passing through waterproof membrane, before membrane is installed. Use cold mastic between sleeve and conduit.

3.4.5. Do not place conduits is slabs in which slab thickness is less than 4 times conduit diameter.

3.4.6. Encase conduits completely in concrete with minimum 25 mm (1 in.) concrete cover.

3.4.7. Organize conduits in slab to minimize cross-overs.

3.5. CONDUITS IN CAST-IN-PLACE SLABS ON GRADE

3.5.1. Run conduits 25 mm (1”) and larger below slab and encased in 75 mm (3 in.) concrete envelope. Provide 50 mm (2 in.) of sand over concrete envelope below floor slab.

3.6. CONDUITS UNDERGROUND

3.6.1. Slope conduits to provide drainage.

3.6.2. For all non-PVC conduits run underground, provide waterproof joints with heavy coat of bituminous paint.

END OF SECTION 16111

1. General

1.1. WORK INCLUDED

1.1.1. Conform to Section 16010 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

1.2. SECTION INCLUDES

1.2.1. Cable trays and accessories.

1.3. REFERENCES

1.3.1. ANSI/NFPA 70 – National Electrical Code.

1.3.2. CSA-C22.1 – Canadian Electrical Code

1.3.3. ASTM B 633 – Specification for Electrodeposited Coatings of Zinc on Iron and Steel

1.3.4. ASTM A 653 – Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot Dip Process

1.3.5. ASTM A 123 – Specification for Zinc (Hot Galvanized) Coatings on Iron and Steel

1.3.6. ASTM A 510 – Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel

1.3.7. NEMA VE 1-2002 – Metal Cable Tray Systems

1.3.8. NEMA VE 2-2002 – Cable Tray Installation Guidelines

1.3.9. ASTM A 641 – Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire

1.3.10. ASTM A 580 – Standard Specification for Stainless Steel Wire

1.3.11. ASTM D 769 – Standard Specification for Black Oxide Coatings

1.4. SUBMITTALS

1.4.1. Shop Drawings: Indicate tray type, dimensions, support points, and finishes.

1.4.2. Product Data: Provide data for fittings and accessories.

1.4.3. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by Product testing agencies specified under article 1.2 –References. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.

1.5. PROJECT RECORD DOCUMENTS

1.5.1. Record Drawings to indicate actual routing of cable tray and locations of supports.

1.6. QUALIFICATIONS

1.6.1. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum five years of experience.

1.6.2. Furnish Products listed and classified by UL Inc., CSA, CUL, as suitable for purpose specified and shown.

2. Products

2.1. LADDER-TYPE CABLE TRAY

2.1.1. Description: NEMA VE 1, Class C ladder type tray, 65 lbs/foot.

2.1.2. Material: Hot dipped galvanized steel.

2.1.3. Inside Width: as indicated.

2.1.4. Inside Depth: 100mm or as indicated.

2.1.5. Straight Section Rung Spacing: 300 mm on centre for electrical wiring or 150mm on communication cable trays.

2.1.6. At junctions of cable trays provide manufactured transition pieces with a bending radius equal to or larger than the width of the cable tray.

2.1.7. Provide manufacturer's standard clamps, hangers, brackets, splice plates, reducer plates, blind ends, barrier strips, connectors, and grounding straps.

2.1.8. Covers: not required unless indicated on drawings.

2.2. WIRE BASKET SECTIONS AND COMPONENTS

2.2.1. Provide wire basket of types and sizes indicated; with connector assemblies, clamp assemblies, connector plates, splice plates and splice bars. Construct units with rounded edges and smooth surfaces; in compliance with applicable standards; and with the following additional construction features.

2.2.2. Materials and Finishes: Material and finish specifications for wire basket sections and components to be Pre-Galvanized Zinc with straight sections made from pre-galvanized steel meeting the minimum mechanical properties of ASTM A 641 unless one of the following finishes is noted on the drawings:

.1 Stainless Steel: Straight sections and accessories shall be made from AISI Type 316L Stainless Steel meeting the minimum mechanical properties of ASTM A 580.

.2 Powder Coat: Straight sections shall be powder coated black with an average paint thickness of 1.2mils (30microns) to 3.0mils (75microns). Colour to be custom and selected during shop drawing stage.

.3 Hot Dipped Galvanizing: Straight sections shall be made from steel meeting the minimum mechanical properties of ASTM A 510, Grade 1008 and shall be hot dipped galvanized after fabrication in accordance with ASTM A 123.

2.2.3. Type of Wire Basket Support System

.1 All straight section longitudinal wires shall be constructed with a continuous top wire safety edge. Safety edge must be kinked and T-welded on all tray sizes.

.2 Wire basket shall be made of high strength steel wires and formed into a standard 2 inch by 4 inch wire mesh pattern with intersecting wires welded together. All mesh sections must have at least one bottom longitudinal wire along entire length of straight section.

.3 Wire basket sizes shall conform to the following nominal criteria:

.1 Straight sections shall be furnished in standard lengths.

.2 Wire diameter shall be 0.196” (5mm) minimum on all mesh sections (minimum size of 4.5mm on stainless steel).

.3 Wire basket shall have a minimum usable loading depth of 100mm (4”) unless 50mm (2”) or 150mm (6”) is noted on the drawings by a width noted on the drawings. If no width is detailed then 300mm (12”) will be the minimum.

.4 All fittings shall be field formed, from straight sections, in accordance with manufacturer’s instructions.

.5 All splicing assemblies shall be UL/CSA approved as an Equipment Ground Conductor (EGC). When using powder coated wire basket as an EGC, the paint must be completely removed at all contact points of splice/ground bolt attachment.

.6 Wire basket supports shall be trapeze hangers unless center support hangers or wall brackets are noted on the drawings. Trapeze hangers or center support hangers shall be supported by 1/4 inch or 3/8 inch diameter rods.

.7 Special accessories shall be furnished as required to protect, support and install a wire basket support system.

2.2.4. Provide manufacturer’s standard clamps, hangers, brackets, splice plates, reducer plates, blind ends, barrier strips, connectors, and grounding straps.

2.2.5. Covers: not required unless indicated on drawings.

2.3. WARNING SIGNS

2.3.1. Nameplates: 12.7 mm (1/2 in.) high black letters on yellow plastic nameplates, with the following wording:

.1 WARNING! DO NOT USE CABLE TRAY AS WALKWAY, LADDER, OR SUPPORT. USE ONLY AS MECHANICAL SUPPORT FOR CABLES AND TUBING!

2.4. MANUFACTURERS

2.4.1. The following are approved manufacturers:

.1 CER- Canadian Electric Raceways.

.2 Pursley.

.3 B-Line.

.4 Pilgrim.

.5 Columbia-MBF-Cope

.6 Legrand

3. Execution

3.1. INSTALLATION

3.1.1. Install in accordance with manufacturer's instructions.

3.1.2. Install metallic cable tray in accordance with NEMA VE 1. Install wire basket in accordance with NEMA VE-2, to ensure that the cable tray equipment complies with requirements of all applicable codes including the electrical code.

3.1.3. Provide supports at each connection point, at the end of each run, and at other points to maintain spacing between supports of 3 m (10 ft.).

3.1.4. Use expansion connectors where required.

3.1.5. Grounding and bonding:

.1 Provide continuity between tray components.

.2 Use anti-oxidant compound to prepare aluminum contact surfaces before assembly.

.3 Provide 6 AWG bare copper equipment grounding conductor through entire length of tray; bond to each component.

.4 Connections to tray may be made using mechanical or exothermic connectors.

.5 Install warning signs at 15.25 m (50 ft.) centers along cable tray, located to be visible.

END OF SECTION 16120

1. General

1.1. WORK INCLUDED

1.1.1. Conform to Section 16010 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

1.2. REFERENCES

1.2.1. CSA C22.2 No.0.3-92, Test Methods for Electrical Wires and Cables.

1.2.2. CSA C22.2 No.38-05, Thermoset-Insulated Wires and Cables

1.2.3. CSA C22.2 No. 75-03, Thermoplastic-Insulated Wires and Cables

1.2.4. CSA-C22.2 No. 51-95, Armoured Cables

1.2.5. CSA-C22.2 No.131-M89 (R1994), Type TECK 90 Cable.

1.2.6. ASTM B800 - Standard Specification for 8000 Series Aluminum Alloy Wire for Electrical Purposes-Annealed and Intermediate Tempers

1.3. PRODUCT DATA

1.3.1. Submit product data in accordance with Section 16010 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

2. Products

2.1. BUILDING WIRES

2.1.1. Conductors: stranded for 10 AWG and larger. Minimum size: 12 AWG.

2.1.2. Contractor to provide copper conductors on all conductors sizes.

2.1.3. All conductors to have size as indicated, with insulation of chemically cross-linked thermosetting polyethylene material rated RW90 or RWU90 to CSA C22.2 No.38 rated as follows:

.1 Insulation rated at 1000V for 600V systems that are ungrounded or have a neutral grounding resistor to limit ground fault current

.2 Insulation rated at 600V for the other 600V and 347/600V distribution systems not covered under item #1 above.

.3 Insulation rated at 600V for all systems rated at 480V and less.

2.1.4. RWU-90 wiring is to be used for underground installations.

2.2. TECK CABLE

2.2.1. Cables to CAN/CSA-C22.2 No.131.

2.2.2. Conductors:

.1 Grounding conductor copper.

.2 Circuit conductors: copper, size as indicated unless aluminium or NUAL is identified on the drawings. Aluminium or NUAL conductor to be provided as per item 2.1.4.

2.2.3. Insulation:

.1 Chemically cross-linked thermosetting polyethylene type RW90, rated 1000 V.

2.2.4. Inner jacket: polyvinyl chloride material.

2.2.5. Armour: interlocking aluminum.

2.2.6. Overall covering: thermoplastic polyvinyl chloride material rated at a minimum of FT-4. Provide FT-6 jacket when TECK cables are run in return air plenum.

2.3. MINERAL-INSULATED CABLES

2.3.1. Conductors: solid bare soft-annealed copper, size as indicated.

2.3.2. Insulation: compressed powdered magnesium oxide to form compact homogeneous mass throughout entire length of cable.

2.3.3. Overall covering: annealed seamless copper sheath, Type M1 rated 600 V, 250 C.

2.3.4. Outer jacket: PVC applied over sheath.

2.3.5. Two hour fire rating.

2.3.6. Conform to requirements of CSA C22.2 # 124; and ULC S 139.

2.4. ARMOURED CABLES

2.4.1. Cables to: CSA-C22.2 No. 51-95.

2.4.2. Circuit conductors: copper, size as indicated unless aluminium or NUAL is identified on the drawings. Aluminium or NUAL conductor to be provided as per item 2.1.4.

2.4.3. Type: AC90 (BX).

2.4.4. Armour: interlocking type fabricated from aluminium strip.

2.4.5. Type: ACWU90 - PVC flame retardant jacket over armour meeting requirements of Vertical Tray Fire Test of CSA C22.2 No.0.3 with maximum flame travel of 1.2 m (3 ft. 11 in.).

2.5. ALUMINUM SHEATHED CABLE

2.5.1. Circuit conductors: copper, size as indicated.

2.5.2. Insulation: type RA90 rated 1000 V.

2.5.3. Sheath: aluminium applied to form continuous corrugated seamless sheath.

2.5.4. Outer jacket of PVC applied over sheath for direct burial or wet locations.

3. Execution

3.1. GENERAL

3.1.1. Provide a minimum of one grounding wire for each three ungrounded conductors on all cable runs. Size grounding to Table 16 of the Canadian Electrical Code. Provide separate ground conductors for ground fault circuit interrupter circuits. All ground conductors to be copper and insulated with a green coloured insulation.

3.1.2. All equipment, junction boxes, pull boxes, liquid tight flex, etc. to be grounded through ground wires.

3.1.3. Provide separate neutral conductor for each 120 volt circuit for all circuits feeding receptacles and power outlets.

3.1.4. All cable terminations to be compression type fittings for wire sizes greater than #8AWG. All compression type fittings to be two-hole long barrel type. Where mechanical screw type lugs are allowed by the Consultant, they will be suitable for quantity of parallel runs of wire that are to be terminated under.

3.1.5. Armoured Cable Type AC90 (BX) may only be used for individual drops from slab mounted junction box to surface or recessed mounted light fixtures. The maximum allowable distance of armoured cable is 3m. Contractor to receive written approval from the Consultant to run armoured cable further than 3m. Wiring in conduit is to be brought to a junction box to allow for the transition to armoured cable. Armoured cable is not to be installed directly into electrical panels.

3.1.6. Branch circuit wiring to be upsized as follows to address voltage drop when:

.1 The entire length of the circuit wiring exceeds 25m – branch wiring to be a minimum of No. 10 AWG.

.2 The entire length of the circuit wiring exceeds 40m – branch wiring to be a minimum of No. 8 AWG.

.3 The entire length of the circuit wiring exceeds 60m – branch wiring to be a minimum of No. 6 AWG.

3.1.7. Wire Splicing

.1 Splice up to and including No. 6 AWG with nylon insulated expandable spring type connectors.

.2 Splice larger conductors using compression type connectors wrapped in PVC insulation rated at the respective voltage.

3.2. INSTALLATION OF BUILDING WIRES

3.2.1. Install all building wiring in conduit unless otherwise noted. Conduit to be sized to the electrical code unless noted on the drawings or in the specifications.

3.2.2. All conductors are to be colour coded. Provide colour tape at all terminations to identify all conductors in each run.

3.3. INSTALLATION OF TECK90 CABLE, ARMOURED CABLE OR ALUMINUM SHEATHED CABLE

3.3.1. Group cables wherever possible on channels.

3.3.2. Terminate cables in accordance with manufacturer's instructions.

3.3.3. Fastenings:

.1 One hole steel straps to secure surface cables 50 mm (2 in.) and smaller. Two hole steel straps for cables larger than 50 mm (2 in.).

.2 Channel type supports for two or more cables.

.3 Galvanized threaded rods: 6 mm (1/4 in.) dia. minimum to support suspended channels.

3.3.4. Connectors:

.1 Watertight, approved for respective cables.

3.4. INSTALLATION OF MINERAL – INSULATED CABLES

3.4.1. Handling:

.1 Cable shall be uncoiled by rolling or rotating supply reel. Do not pull from coil periphery or centre.

3.4.2. Bending:

.1 Not less than six (6) times the cable diameter for cable not more than ¾ inch (250 kcmil).

.2 Not less than twelve (12) times the cable diameter for cable diameter for cable more than ¾ inch (350 and 500 kcmil).

3.4.3. Splicing:

.1 All fire rated splices shall be made in the factory. In the event of a field splice is necessary, it must be made in the field by manufacturer's field technician.

3.4.4. Terminations:

.1 Field made terminations shall be made with cable manufacturer's termination kits only. Stripping tools, crimping and compression tools available from the manufacturer shall be used for proper cable termination.

.2 Connections to ferrous cabinets for single conductor cables shall incorporate brass plates. Installed per manufacturer's drawing.

.3 At cable terminations use thermoplastic sleeving over bare conductors.

3.4.5. Sheath induction reduction:

.1 When multi-phase circuits have paralleled single conductors, cables shall be run in groups having one of each phase in each group.

.2 Each set of paralleled conductors shall be separated by at least two single cable diameters.

3.4.6. Exposed or Surface Installations:

.1 Cable shall be secured directly to fire rated building structure using:

.1 Straps: 13 mm (½ in.) wide x 38 mm (3½ in.) long by 0.75 mm (1/32 in.) thick stainless steel or copper straps. Each strap shall contain two 5 mm (¼ in.) holes for securing with 5 mm (3/16 in.) by minimum 44 mm (1-3/4 in.) long steel anchors.

.2 Support 2 hr fire rated cables at 1 m (3 ft. 3 in.) intervals.

3.4.7. Wall or floor penetrations:

.1 Provide approved fire stopping of all penetrations.

.2 Neatly train and lace cable inside boxes, equipment, and panelboards.

.3 Where cables are buried in cast concrete or masonry, sleeve for entry of cables.

3.4.8. Field quality control

.1 Prior to energizing cables, measure insulation resistance of each cable. Ensure readings are acceptable per Installation recommendations. Tabulate and submit for approval.

3.5. INSTALLATION OF CONTROL CABLES

3.5.1. Install control cables in conduit.

3.5.2. Ground control cable shield.

END OF SECTION 16122

1. General

1.1. WORK INCLUDED

1.1.1. Section 16010 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

1.1.2. Section 16060 – ACCESS DOORS AND ACCESSIBILITY.

1.2. REFERENCE

1.2.1. CSA 2.2.1 - Canadian Electrical Code - Part 1.

1.3. SHOP DRAWINGS AND PRODUCT DATA

1.3.1. Submit Shop Drawings and product data for cabinets in accordance with Section 16010 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

2. Products

2.1. SPLITTERS

2.1.1. Sheet metal enclosure, welded corners and formed hinged cover suitable for locking in closed position. Provide CSA Type 1 enclosures in non-sprinklered environments and CSA Type 4/12 in sprinklered environments.

2.1.2. Main and branch lugs to match required size and number of incoming and outgoing conductors as indicated.

2.1.3. At least three spare terminals on each set of lugs in splitters less than 400 A.

2.2. JUNCTION AND PULL BOXES

2.2.1. Welded steel construction with screw-on flat covers for surface mounting.

2.2.2. Covers with 25 mm (1 in.) minimum extension all around, for flush-mounted pull and junction boxes.

2.3. CABINETS

2.3.1. Type E: sheet steel, hinged door and return flange overlapping sides, handle, lock and catch, for surface mounting.

2.3.2. Type T: sheet steel cabinet, with hinged door, latch, lock, 2 keys, containing 19 mm (3/4 in.) plywood backboard for surface or flush mounting. The plywood backboard is to have a fire-resistant coating on the front.

3. Execution

3.1. SPLITTER INSTALLATION

3.1.1. Install splitters and mount plumb, true and square to the building lines.

3.1.2. Extend splitters full length of equipment arrangement except where indicated otherwise.

3.2. JUNCTION, PULL BOXES AND CABINETS INSTALLATION

3.2.1. Install pull boxes in inconspicuous but accessible locations.

3.2.2. Mount cabinets with top not higher than 2 m (8 ft.) above finished floor.

3.2.3. Install terminal block as indicated in Type T cabinets.

3.2.4. Only main junction and pull boxes are indicated. Install pull boxes as follows:

.1 A conduit run exceeds 30 m (98 ft. 5 in.) and;

.2 360 degree of combined bends between pull boxes for power conduits or 180 degree of combined bends between pull boxes for communication and low voltage conduits.

3.3. IDENTIFICATION

3.3.1. Provide equipment identification in accordance with Section 16010 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

3.3.2. Install identification labels indicating system name voltage and phase.

END OF SECTION 16131

1. General

1.1. WORK INCLUDED

1.1.1. Conform to Section 16010 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

1.2. REFERENCES

1.2.1. CSA C22.1-Canadian Electrical Code, Part 1.

2. Products

2.1. OUTLET AND CONDUIT BOXES GENERAL

2.1.1. Size boxes in accordance with CSA C22.1.

2.1.2. Square or larger outlet boxes as required for special devices.

2.1.3. Gang boxes where wiring devices are grouped.

2.1.4. Blank cover plates for boxes without wiring devices.

2.1.5. 347V outlet boxes for 347 V switching devices.

2.1.6. Combination boxes with barriers where outlets for more than one system are grouped.

2.2. SHEET STEEL OUTLET BOXES

2.2.1. Electro-galvanized steel single and multi gang flush device boxes for flush installation, minimum size 75 mm x 50 mm x 38 mm (3 in. x 2 in. x 1-1/2 in.) or as indicated. 100 mm (4 in.) square outlet boxes when more than one conduit enters one side with extension and plaster rings as required.

2.2.2. Provide cast FS aluminum boxes with factory-threaded hubs and mounting feet for surface wiring of switches and receptacles connected to rigid conduit.

2.2.3. Provide electro-galvanized steel utility boxes for surface mounted boxes connected to surface-mounted EMT conduit, minimum size 100 mm x 54 mm x 48 mm (4 in. x 2-1/8 in. x 1-7/8 in.).

2.2.4. Square or octagonal outlet boxes for lighting fixture outlets.

2.2.5. Square outlet boxes with extension and plaster rings for flush mounting devices in finished plaster or tile walls.

2.3. MASONRY BOXES

2.3.1. Electro-galvanized steel masonry single and multi gang boxes for devices flush mounted in exposed block walls.

2.4. CONCRETE BOXES

2.4.1. Electro-glavanized sheet steel concrete type boxes for flush mount in concrete with matching extension and plaster rings as required.

2.5. OUTLET BOXES FOR NON-METALLIC SHEATHED CABLE

2.5.1. Electro-galvanized, sectional, screw ganging steel boxes, minimum size 75 mm x 50 mm x 63.5 mm (3 in. x 2 in. x 2½ in.) with two double clamps to take non-metallic sheathed cables.

2.6. FITTINGS - GENERAL

2.6.1. Bushing and connectors with nylon insulated throats.

2.6.2. Knock-out fillers to prevent entry of debris.

2.6.3. Conduit outlet bodies for conduit up to 31.75 mm (1-1/4 in.) and pull boxes for larger conduits.

2.6.4. Double locknuts and insulated bushings on sheet metal boxes.

2.7. SERVICE FITTINGS

2.7.1. 'High tension' receptacle fitting made of 2 piece die-cast aluminum with brushed aluminum housing finish for duplex receptacles. Bottom plate with two knockouts for centered or offset installation.

2.7.2. Pedestal type 'low tension' fitting made of 2 piece die cast aluminum with brushed aluminum housing finish to accommodate amphenol jack connectors.

3. Execution

3.1. INSTALLATION

3.1.1. Support boxes independently of connecting conduits.

3.1.2. Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.

3.1.3. For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm (1/4 in.) of opening.

3.1.4. Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Reducing washers are not allowed.

END OF SECTION 16132

1. General

1.1. WORK INCLUDED

1.1.1. Section 16010 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

1.1.2. Section 16141 – WIRING DEVICES.

1.1.3. Section 16122 – WIRES AND CABLES 1000V.

1.2. REFERENCE

1.2.1. CSA C22.2 No. 62 – Surface Metal Raceways

1.3. SHOP DRAWINGS AND PRODUCT DATA

1.3.1. Submit Shop Drawings and product data in accordance with Section 16010 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

1.3.2. If variations from the reviewed shop drawings occur during the installation of the system, final as built drawings shall be submitted for each floor that has been altered.

2. Products

2.1. SURFACE RACEWAY FOR WIRING DEVICES

2.1.1. The raceway and all system components must be CSA listed.

2.1.2. Raceway to be constructed of galvanized steel unless stainless steel is identified on the drawings. Raceway base shall have a minimum thickness of 1.3 mm (0.050 in.) and the cover shall have a minimum thickness of 1 mm (0.040 in.).

2.1.3. Raceways shall be painted with the colour to be determined by the architect at the time of shop drawing stage. Submit available colour selections with the shop drawing submittal.

2.1.4. The raceway shall have a minimum of two compartments unless additional compartments are identified on the drawings. Assembled base and cover shall be a 120 mm (4¾ in.) wide for two section raceway and additional 60 mm (2-3/8 in.) for every additional compartment with a minimum depth of 45 mm (1¾ in.) unless specified otherwise on the drawing.

2.1.5. The raceway shall be a modular design with separate covers for each compartment divided with fixed barriers. The compartment covers to be snap on design, which snap side by side on a common base. Raceway covers shall be enhanced tamper resistant form, where screws are only necessary on access plates and the covers of certain fittings, but not on standard cover lengths. A tool shall be provided to form the shape in the cover flange necessary to maintain enhanced tamper resistance when the cover is field cut. Another tool shall be provided for cutting covers to ensure square field cuts.

2.1.6. Provide all required fittings including, but not limited to flat, internal and external elbows, couplings for joining raceway sections, wire clips, blank end fittings, entrance fittings, and a full compliment of device mounting brackets and plates. All fittings shall be an enhanced tamper resistant form and shall be divided with barriers and made to match the size of the accompanying raceway base.

2.1.7. Provide full capacity corner elbows and tee fittings to maintain a controlled 50 mm (2 in.) cable bend radius, which meets the specifications for Fiber Optic cabling and exceeds the TIA 569 requirements for communications pathways.

2.1.8. Device brackets shall be provided in sizes to match the width of the raceway and with mounting holes appropriately located to ensure proper mounting of devices in all compartments.

2.1.9. Device plates shall be made in any length from 152.4 mm (6 in.) to 1.5 m (60 in.) with cut outs to accommodate various combinations of power and/or communication devices in all compartments. Device plates shall be 152.4 mm (6 in.) and 304.8 mm (12 in.) long with a flange to overlap the joint of the adjacent cover. Provide 5% additional device plates for future additions or modifications for all types of devices installed.

2.2. MANUFACTURERS

2.2.1. The following are approved manufacturers:

.1 CER- Canadian Electric Raceways.

.2 Legrand – Wiremold

3. Execution

3.1. INSTALLATION

3.1.1. Prior to and during installation, refer to system layout or approval drawings containing all elements of the system. Installer shall comply with detailed manufacturer’s instruction sheets, which accompany system components, as well as complete system instruction sheets, whichever is applicable.

3.1.2. All raceway systems shall be mechanically continuous and connected to all electrical outlets, boxes, device mounting brackets, and cabinets, also in accordance with manufacturer’s installation sheets.

3.1.3. All metal raceway shall be electrically continuous and bonded in accordance with the respective Electrical Code for proper grounding. Provide a separate insulated ground conductor in the entire length of the raceway.

3.1.4. Raceway shall be securely supported at intervals not exceeding 1500 mm (5 ft.) or in accordance with manufacturer’s installation sheets.

3.1.5. All raceway systems shall be installed complete, including insulating bushings and inserts where required by manufacturer’s installation sheets. All unused raceway openings shall be closed.

3.1.6. Locate wireway and wiring devices as shown.

3.1.7. Install supports, elbows, tees, connectors and fittings. Keep the number of elbows, offsets and connections to a minimum.

3.1.8. Install wiring and wiring devices as indicated.

3.1.9. Install barriers to separate different wiring systems .

END OF SECTION 16139

1. General

1.1. WORK INCLUDED

1.1.1. Conform to Section 16010 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

1.2. SHOP DRAWINGS AND PRODUCT DATA

1.2.1. Submit Shop Drawings and product data in accordance with Section 16010 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

2. Products

2.1. SWITCHES

2.1.1. 20 A, single pole, double pole, three-way, or four-way specification grade switches. Voltage rating of the switch to be as per the contract documents.

2.1.2. Manually-operated general purpose ac switches with following features:

.1 Terminal holes approved for No. 10 AWG wire.

.2 Silver alloy contacts.

.3 Urea or melamine moulding for parts subject to carbon tracking.

.4 Suitable for back and side wiring.

.5 Décor Style specification grade Rocker switch.

.6 Colour to be selected by Architect/Consultant.

2.1.3. Toggle operated locking fully rated for tungsten filament and fluorescent lamps, and up to 80% of rated capacity of motor loads.

2.2. RECEPTACLES

2.2.1. All receptacles to be specification grade.

2.2.2. Duplex specifications receptacles, Décor style CSA type 5-15 R, 125 V, 15 A, U ground, with following features:

.1 Thermoplastic with impact-resistant nylon face moulded housing.

.2 Suitable for No. 10 AWG for back and side wiring.

.3 Eight back wired entrances, four side wiring screws.

.4 Triple wipe contacts and riveted grounding contacts.

2.2.3. Single receptacles CSA type 5-15 R, 125 V, 15 A, U ground with following features

.1 Thermoplastic moulded housing.

.2 Suitable for No. 10 AWG for back and side wiring.

.3 Four back wired entrances, 2 side wiring screws.

2.2.4. Other receptacles with ampacity and voltage as indicated.

2.2.5. Receptacles to be coloured as follows:

.1 Normal Power – Colour to be selected by Architect/Consultant

.2 Emergency/Essential Power – Red

.3 Isolated Ground - Orange

2.3. MANUFACTURERS

2.3.1. The switches and wiring devices shall be of one manufacturer throughout the project.

2.3.2. The following are acceptable manufacturers:

.1 Legrand

.2 Hubbell

.3 Cooper

.4 Leviton

2.4. DIMMERS

2.4.1. Dimmers shall be 600W, 1500W, 2000 Watts.

.1 Full range, continuously variable control of light intensity.

.2 Vertical slider allowing the light level to be set by the user.

.3 Slide to Off.

.4 Capable of operating at rated capacity.

.5 Power failure memory

.6 Dimmers shall be available for direct control of incandescent, magnetic low voltage, electronic low voltage, electronic low voltage and fluorescent.

2.4.2. Incandescent dimmers.

.1 Direct control of up to a full 20A lighting circuit.

2.4.3. Electronic (solid-state) Low Voltage (ELV) transformer dimmers (incandescent).

.1 Circuitry designed to control the input of Electronic (solid state) Low Voltage transformers.

.2 Control up to 600 Watts of Electronic Low Voltage load.

.3 Reset-able overload protection when capacity is exceeded.

2.4.4. Magnetic Low-Voltage (MLV) transformer dimmers.

.1 Designed to control and provide a symmetrical AC wave form to input of magnetic low voltage transformers per UL 1972 section 5.11.

.2 Direct control of up to 1500VA of Magnetic Low Voltage load.

.3 Dimmer shall be suitable to control dimming ballast as specified in Section 16505 – LIGHTING EQUIPMENT.

2.4.5. LED dimmers.

.1 Slide to Off only. Must match driver and LED requirements.

2.4.6. Manufactures

.1 Lutron Nov. T Series.

.2 Leviton Monet Series.

2.5. SPECIAL WIRING DEVICES

2.5.1. Pilot lights as indicated, with neon type 0.04 W, 125 V lamp and red plastic lens flush type

2.6. COVER PLATES

2.6.1. Cover plates for wiring devices.

2.6.2. Cover plates from one manufacturer throughout project.

2.6.3. Sheet steel utility box cover for wiring devices installed in surface-mounted utility boxes.

2.6.4. Provide stainless steel cover plates, suitable for the respective device, for all devices mounted in flush-mounted outlet boxes located in finished areas.

2.6.5. Sheet metal cover plates for wiring devices mounted in surface-mounted FS or FD type conduit boxes.

2.6.6. Weatherproof double lift spring-loaded cast aluminum cover plates, complete with gaskets for duplex receptacles located outside or as indicated.

2.6.7. Weatherproof spring-loaded cast aluminum cover plates complete with gaskets for single receptacles or switches located outside or as indicated.

3. Execution

3.1. INSTALLATION

3.1.1. Switches:

.1 Install single throw switches with handle in "UP" position when switch closed.

.2 Install switches in gang type outlet box when more than one switch is required in one location.

.3 Mount toggle switches at height specified in Section 16010 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS or as indicated.

3.1.2. Receptacles:

.1 Install receptacles in gang type outlet box when more than one receptacle is required in one location.

.2 Mount receptacles at height specified in Section 16010 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS or as indicated.

.3 Where split receptacle has one portion switched, mount vertically and switch upper portion.

3.1.3. Cover plates:

.1 Protect stainless steel cover plate finish with paper or plastic film until painting and other work is finished.

.2 Install suitable common cover plates where wiring devices are grouped.

.3 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.

END OF SECTION 16141

1. General

1.1. WORK INCLUDED

1.1.1. Conform to Section 16010 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

1.1.2. Section 16477 – MOULDED CASE CIRCUIT BREAKERS.

1.1.3. Section 16478 – FUSES LOW VOLTAGE

1.2. REFERENCE

1.2.1. CAN/CSA C22.2 No. 31 – Switchboards.

1.3. SHOP DRAWINGS AND PRODUCT DATA

1.3.1. Submit Shop Drawings and product data in accordance with Section 16010 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

1.3.2. Indicate on Shop Drawings:

- .1 Floor or wall anchoring method and foundation template.
- .2 Dimensioned cable entry and exit locations.
- .3 Dimensioned position and size of bus.
- .4 Overall length, height and depth.
- .5 Dimensioned layout of internal and front panel mounted components.

1.3.3. Include time-current characteristic curves for circuit breakers and fuses.

1.4. MAINTENANCE DATA

1.4.1. Submit 3 copies maintenance data for complete assembly including components.

1.5. MAINTENANCE MATERIALS

1.5.1. Include:

- .1 Fuse or breaker types.

1.6. SOURCE QUALITY CONTROL

1.6.1. Submit 3 copies of certified test results.

2. Products

2.1. SWITCHBOARD

2.1.1. Ratings as identified on the drawings and/or schedules.

2.1.2. Switchboard breakers to have a minimum short circuit current rating of 22kA at 600V. Fused sections to have a minimum short circuit current rating of 100kA at 600V. Switchboard busing to be rated at a minimum of 65kA.

2.1.3. Enclosures to be dead front, CSA Type 2 sprinklered enclosure, size as indicated.

2.1.4. Hinged access panels with captive knurled thumb screws.

2.1.5. Bus bars and main connections: copper.

2.1.6. Bus from load terminals of main breaker via metering section to main lugs of distribution section.

2.1.7. Identify phases with colour coding.

2.1.8. Provide two hole long barrel compression lugs for the main feeder terminations. Size as per the drawings.

2.2. CIRCUIT BREAKERS

2.2.1. Circuit breakers to be supplied as per Section 16477 – MOULDED CASE CIRCUIT BREAKERS.

2.2.2. All breakers to be factory installed and tested.

2.3. FUSIBLE DISCONNECTS AND FUSES

2.3.1. Fusible horsepower rated disconnect switch sized as indicated.

2.3.2. Provision for padlocking in on-off position by three padlocks.

2.3.3. Mechanically interlocked door to prevent opening when handle is in the ON position.

2.3.4. Fuse: size as indicated, class J, current limiting in fuse holders without adapters. Fuses to be supplied as per Section Section 16478 – FUSES LOW VOLTAGE.

2.3.5. Quick-make, quick-break action.

2.3.6. ON-OFF switch position indication on switch enclosure cover.

2.4. GROUNDING

2.4.1. Copper ground bus extending full width of cubicles and located at bottom.

2.4.2. Provide two hole long barrel compression lugs for the ground cable terminations. Size as per the drawings.

2.5. ACCESSORIES

2.5.1. For all switchboards with draw out circuit breakers provide one circuit breaker lifting device - portable, floor-supported with a roller base. All four wheels are to be swivelling type to allow the lifting device to me moved in any direction. Also provide same portable lifting device with each outdoor non-walk-in lineup(s). Provide one lifting device in each room containing draw out circuit breakers.

2.6. FINISHES

2.6.1. Apply finishes in accordance with Section 16010 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

2.6.2. Switchboard to be painted: baked grey enamel.

2.7. EQUIPMENT IDENTIFICATION

2.7.1. Provide equipment identification in accordance with Section 16010 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS and Section16056 – IDENTIFICATION.

2.7.2. Label all branch feeders on panel with names as indicated on drawings.

2.8. FACTORY TESTING

2.8.1. Testing shall be witnessed by the Technical Service Start-Up Services Contractor.

2.8.2. Include in your bid for the complete cost of two people to attend the factory witness testing for the equipment. Cost to include but not limited to all travel, food and lodging costs.

2.9. MANUFACTURERS

2.9.1. The switchboards shall be manufactured by:

.1 Schneider Electric.

.2 Eaton Cutler-Hammer.

.3 Siemens.

3. Execution

3.1. INSTALLATION

3.1.1. Locate switchboard and secure in position. Install floor mounted switchboards on a 100 mm (4 in.) concrete housekeeping pad.

3.1.2. Connect main incoming feeder to line terminals of main breaker, if applicable.

3.1.3. Connect load terminals of distribution switches or breakers to feeders.

3.1.4. Check factory made connections for mechanical security and electrical continuity.

3.1.5. Check trip unit settings and fuse sizes against co-ordination study to ensure proper working and protection of components.

3.2. TESTING

3.2.1. Contractor to review and test that all wiring has been connected as per the manufacturer drawings.

3.2.2. Switchgear to be tested on site as defined in Section 16025 – TECHNICAL SERVICES DIVISION STARTUP SERVICE. Contractor to oversee all testing and correct any deficiencies noted.

END OF SECTION 16421

1. General

1.1. WORK INCLUDED

1.1.1. Conform to Section 16010 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

1.2. REFERENCE

1.2.1. CSA C22.2 No. 4 – Enclosed Switches.

1.2.2. CSA C22.2 No. 39 – Fuseholder Assemblies.

1.3. PRODUCT DATA

1.3.1. Submit product data in accordance with Section 16010 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

2. Products

2.1. DISCONNECT SWITCHES

2.1.1. Fusible or non-fusible, horsepower rated disconnect switch in CSA Enclosure 2 sprinkler proof, size as indicated.

2.1.2. Provision for padlocking in on-off switch position by three locks.

2.1.3. Mechanically interlocked door to prevent opening when handle in ON position.

2.1.4. Fuses: size as indicated, class J, current limiting, in accordance with Section 16478 – FUSES - LOW VOLTAGE.

2.1.5. Fuseholders: suitable without adaptors, for type and size of fuse indicated.

2.1.6. Quick-make, quick-break action.

2.1.7. ON-OFF switch position indication on switch enclosure cover.

2.2. EQUIPMENT IDENTIFICATION

2.2.1. Provide equipment identification in accordance with Section 16010 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

2.2.2. Indicate name of load controlled on nameplate.

2.2.3. Provide a lamacoid that indicates the replacement fuse size as well as the maximum allowable fuse size for that disconnect based upon the sizing of the feeder.

2.3. MANUFACTURERS

2.3.1. The following are acceptable manufacturers

.1 Schneider Electric

.2 Eaton Cutler-Hammer

.3 Siemens

3. Execution

3.1. INSTALLATION

3.1.1. Install disconnect switches complete with fuses if applicable.

END OF SECTION 16440

1. General

1.1. WORK INCLUDED

1.1.1. Conform to Section 16010 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

1.2. REFERENCES

1.2.1. CSA C22.2 No. 41-M2007 – Grounding and Bonding of Equipment

1.3. DESCRIPTION

1.3.1. Provide system grounding to meet requirements of current Canadian Electrical Code and all applicable Codes.

1.3.2. Supply and install station ground electrodes, consisting of a minimum of four (4) driven ground rods not less than 3m long and 19.00mm in diameter and where practicable located adjacent to the equipment to be grounded; otherwise install the ground rods at the lowest floor level of the building. Interconnect all ground bars underground with a #4/0 AWG bare ground conductor.

1.3.3. Supply and install a new ground bus system, consisting of a length of copper bus, 25 mm (1 in.) thick ebony pad with chamfered edges as shown on the drawings. A minimum of two 1200mm ground bars are to be provided in transformer vaults, main electrical rooms and generator room. Where a perimeter ground bus is shown on the drawings, supply and install a 50mm x 6mm on all walls attached at 1.5m intervals on 13mm standoffs. The perimeter ground bus shall be continuous around the room and shall be continued above or below all such opening as door and vents.

1.3.4. Connect each ground bar with a minimum of two #4/0 AWG conductors to the main ground grid for the building. Connect the ground bar to each of the ground rods with #3/0 minimum ground conductors if the ground rods are driven in the respective room otherwise run a minimum of two #4/0 AWG conductors to the remote ground grid.

1.3.5. Connect to the ground loop all transformer neutrals, switchboard neutral and all metal equipment enclosures as well as all other metal parts such as mechanical pipes, ducts, waste lines, door frames, railings, grilles, fences, etc.

1.3.6. Provide cable grips to receive all grounding conductors. Identify all grounding conductors at the ground pad using lamacoid nameplates. Ground bus system to be provided in rooms as shown.

1.3.7. Terminate the following conductors at the ground bus system:

Service neutral	-3/0 AWG
Telephone ground	-2 AWG
Main system ground	-3/0 AWG
Bonding cable	-3/0 AWG

1.3.8. All metal parts at the electrical area main distribution center shall be bonded to the main ground bus using 4 AWG stranded bare copper cable or 6 mm x 13 mm (1/4 in. x ½ in.) copper strap.

1.3.9. Bond and ground all metallic water and waste systems in accordance with code requirements.

1.3.10. Install grounding connections to typical equipment included in, but not necessarily limited to, following list: frames of motors, starters, control panels, building steel work, elevators, distribution panels and outdoor lighting.

1.3.11. Commission an approved Agency to perform a main system ground test and a copy of the report in the maintenance manual. (Refer to Part 3.0).

2. Products

2.1. GROUNDING & BONDING EQUIPMENT

2.1.1. Meet standard of CSA C22.2 No. 41-M2007.

2.2. CONDUCTORS

2.2.1. Bare or insulated, stranded, soft drawn annealed copper wire, for: ground bus, electrode interconnections, metal structures, ground connections, telephone ground.

3. Execution

3.1. INSTALLATION

3.1.1. Install complete permanent, continuous, system and circuit, equipment, grounding systems including, conductors, connectors, accessories, as indicated, to conform to requirements of local authority having jurisdiction over installation.

3.1.2. Install connectors in accordance with manufacturer’s instructions.

3.1.3. Install minimum four (4) ground rods spaced at least the rod length apart and located at the lowest floor of the building.

3.1.4. Ground rods to be interconnected by ground grid conductors (size as per table above) and buried to a maximum depth of 600mm below the rough station grade and a minimum depth of 150mm below the finished station grade.

3.1.5. Protect exposed grounding conductors from mechanical injury.

3.1.6. All grounding connections to be made with two hole, long barrel compression type fittings and lugs.

3.1.7. Install bonding wire for flexible conduit, connected at both ends to grounding bushing, solderless lug, clamp or cup washer and screw. Neatly cleat bonding wire to exterior of flexible conduit.

3.1.8. The contractor shall pay for the testing and verification of the entire building ground system using a certified testing agency. Tests shall include main ground grid and ground rods, ground connections between all service and communication rooms. The agency shall provide complete test reports indicating test methodology and results. All costs shall be included in contract bid.

END OF SECTION 16450

1. General

1.1. WORK INCLUDED

1.1.1. Conform to Section 16010 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

1.2. REFERENCES

1.2.1. CSA C22.2 No. 29 – Panelboards and Enclosed Panelboards

1.2.2. CSA C22.2 No. 5 – Molded-case circuit breakers, molded-case switches and circuit-breaker enclosures.

1.3. SHOP DRAWINGS

1.3.1. Submit Shop Drawings in accordance with Section 16010 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

1.3.2. Drawings to include electrical detail of panel, branch breaker type, quantity, ampacity and enclosure dimension.

2. Products

2.1. PANELBOARDS

2.1.1. Panelboards: product of one manufacturer.

2.1.2. Install circuit breakers in panelboards before shipment.

2.1.3. In addition to CSA requirements manufacturer's nameplate must show fault current that the panel including all breakers have been built to withstand.

2.1.4. Panelboards to have the following minimum ratings for interrupting capacity or as indicated on the drawings or panel schedules.

.1 120/208V panelboards – 10kA

.2 347/600V panelboards – 22kA

2.1.5. Sequence phase bussing with odd numbered breakers on left and even on right, with each breaker identified by permanent number identification as to circuit number and phase.

2.1.6. Panelboards: mains, number of circuits, and number and size of branch circuit breakers as indicated. Provide an additional 20% of space within each panelboard in addition to what is shown on the drawings when a separate panel schedule is not provided for a specific panelboard.

2.1.7. Two keys for each panelboard and key panelboards alike.

2.1.8. Panelboards to be copper bus unless identified otherwise.

2.1.9. Where identified on the drawings or schedules, provide a copper neutral bus sized to 200% of the mains rating for panels.

2.1.10. Mains: suitable for bolt-on breakers.

2.1.11. Trim with concealed front bolts and hinges.

2.1.12. Trim and door finish: baked grey enamel.

.1 Drip hoods for sprinkler proofing.

2.1.13. Enclosure to be CSA Type 2 sprinkler proof.

2.1.14. TVSS protection as required.

2.1.15. Series ratings may be acceptable. Panels to be labeled as such. Manufacturing to supply supporting data.

2.2. MOULDED CASE CIRCUIT BREAKERS

2.2.1. Bolt-on moulded case circuit breaker: quick-make, quick-break type, for manual and automatic operation with temperature compensation for 40 deg. C. (104 deg. F.) ambient.

2.2.2. Common-trip breakers: with single handle for multi-pole applications.

2.2.3. Moulded case circuit breaker to operate automatically by means of thermal and magnetic tripping devices to provide inverse time current tripping and instantaneous tripping for short circuit protection.

2.2.4. Main breaker, where indicated: separately mounted on top or bottom of panel to suit cable entry. When mounted vertically, down position should open breaker.

2.2.5. Lock-on devices for 10 % of 15 to 30 A breakers installed. Turn over unused lock-on devices to Owner.

2.2.6. Where breakers are identified to feed high intensity discharge (HID) lighting, provide breakers that are rated and designed for use with HID lighting.

2.2.7. Provide one breaker per designated breaker space. Multiple breakers contained in one housing or twin breakers are not acceptable.

2.3. EQUIPMENT IDENTIFICATION

2.3.1. Provide equipment identification in accordance with Section 16010 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

2.3.2. Complete circuit directory with typewritten legend showing location and load of each circuit.

2.4. MANUFACTURERS

2.4.1. The following are acceptable manufacturers:

.1 Schneider Electric

.2 Eaton Cutler-Hammer

.3 Siemens

3. Execution

3.1. INSTALLATION

3.1.1. Locate panelboards as indicated and mount securely, plumb, true and square, to adjoining surfaces.

3.1.2. Install surface mounted panelboards on galvanized unistrut stand-offs or on fire rated plywood backboards. The plywood backboards are to be as per Section 16010 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

3.1.3. Mount panelboards to height specified in Section 16010 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS or as indicated.

3.1.4. Connect loads to circuits.

3.1.5. Connect neutral conductors to common neutral bus with respective neutral identified.

END OF SECTION 16471

1. General

1.1. WORK INCLUDED

1.1.1. Conform to Section 16010 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

1.2. REFERENCES

1.2.1. CSA C22.2 No. 29 – Panelboards and Enclosed Panelboards

1.2.2. CSA C22.2 No. 39 – Fuse holder assemblies.

1.3. SHOP DRAWINGS

1.3.1. Submit Shop Drawings in accordance with Section 16010 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

1.3.2. Drawings to include electrical detail and dimensions of panel, branch switch type, ampacity and quantity.

1.4. PLANT ASSEMBLY

1.4.1. Assemble panelboard interior before shipment. Ship fuses loose for on site installation.

1.4.2. In addition to CSA requirements, manufacturer's nameplates must show fault current that panelboard has been built to withstand.

2. Products

2.1. CONSTRUCTION FEATURES

2.1.1. Panelboards: product of one manufacturer.

2.1.2. Sequence phase bussing with odd numbered sections on left and even on right, with each section identified by permanent number identification as to circuit number and phase.

2.1.3. Panelboards with mains, number of circuits, and number and size of branch sections as indicated. Provide an additional 20% of space within each panelboard in addition to what is shown on the drawings when a separate panel schedule is not provided for a specific panelboard.

2.1.4. Panelboards to have the following minimum ratings for interrupting capacity or as indicated on the drawings or panel schedules.

.1 120/208V panelboards – 10kA

.2 347/600V panelboards – 22kA

2.1.5. Two keys for each panelboard and key panelboards alike.

2.1.6. Copper bus with neutral sized to 200% of the mains rating.

2.1.7. Suitable for bolt-on fusible sections.

2.1.8. Trim and door finish: baked grey enamel.

2.1.9. Enclosure to be CSA Type 2 sprinkler proof.

2.1.10. Fusible pull-outs or door-operated type switches not acceptable.

2.1.11. Fuse clips: suitable for HRC type J fuses.

2.2. CUSTOM BUILT PANELBOARD ASSEMBLIES

2.2.1. Double stack panels as indicated.

2.2.2. Contactors in mains as indicated.

2.2.3. Feed through lugs as indicated.

2.3. EQUIPMENT IDENTIFICATION

2.3.1. Provide equipment identification in accordance with Section 16010 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

2.3.2. Nameplate for each panel engraved in 8 mm (5/16 in.) high letters.

2.3.3. Nameplate for each circuit in distribution panels engraved "name of load" as indicated in 5 mm (3/16 in.) high letters.

2.3.4. Complete circuit directory with typewritten legend showing location and load of each circuit. Install circuit directory under plastic protective cover on front of panel.

2.3.5. Provide a lamacoid for each fused circuit that indicates the replacement fuse size.

2.4. MANUFACTURERS

2.4.1. The following are acceptable manufacturers:

.1 Schneider Electric

.2 Eaton Cutler-Hammer

.3 Siemens

3. Execution

3.1. INSTALLATION

3.1.1. Locate panelboards as indicated and mount securely, plumb, and square, to adjoining surfaces.

3.1.2. Install surface-mounted panelboards on plywood backboards. Where practical group panelboards on common backboard. The plywood backboards are to be 19 mm (3/4 in.) thick with a fire-resistant coating on the front.

3.1.3. Mount panels to height specified in Section 16010 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS or as indicated.

3.1.4. Connect loads to circuits.

3.1.5. Connect neutral conductors to common neutral bus.

END OF SECTION 16472

1. General

1.1. WORK INCLUDED

1.1.1. Conform to Section 16010 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

1.2. REFERENCES

1.2.1. Canadian Standards Association (CSA C22.5 No. 5).

1.3. PRODUCT DATA

1.3.1. Include time-current characteristic curves for breakers with ampacity of 400 A and over or with interrupting capacity of 22,000 A symmetrical (rms) and over at system voltage.

2. Products

2.1. BREAKERS GENERAL

2.1.1. Bolt-on moulded case circuit breaker: quick-make, quick-break type, for manual and automatic operation with temperature compensation for 40 deg. C. (104 deg. F.) ambient.

2.1.2. Common-trip breakers: with single handle for multi-pole applications.

2.1.3. Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting. Trip settings on breakers with adjustable trips to range from 3-8 times current rating.

2.1.4. Circuit breakers with interchangeable trips as indicated.

2.2. THERMAL MAGNETIC BREAKERS

2.2.1. Moulded case circuit breaker to operate automatically by means of thermal and magnetic tripping devices to provide inverse time current tripping and instantaneous tripping for short circuit protection.

2.3. MAGNETIC BREAKERS

2.3.1. Moulded case circuit breakers to operate automatically by means of magnetic tripping devices to provide instantaneous tripping for short circuit protection

2.4. FUSED THERMAL MAGNETIC BREAKERS

2.4.1. Fused thermal magnetic breakers with current limiting fuses internally mounted. Time current limiting characteristics of fuses coordinated with time current tripping characteristics of circuit

breaker. Coordination to result in interruption by breaker of fault-level currents up to interrupting capacity of breaker. Fuses individually removable and interlocked with breaker. The removal of fuse cover, blowing of a fuse or removal of a fuse, shall trip the breaker.

2.5. SOLID STATE TRIP BREAKERS

2.5.1. Moulded case circuit breaker to operate by means of a solid-state trip unit with associated current monitors and self-powered shunt trip to provide inverse time current trip under overload condition and long time, short time, instantaneous tripping for phase and ground fault short circuit protection.

2.6. ACCESSORIES

2.6.1. Include:

.1 shunt trip, when electrically operated or when indicated.

.2 auxiliary switches, when electrically operated or when indicated.

.3 motor-operated mechanism, when electrical operation indicated.

.4 on-off locking device.

.5 handle mechanism.

2.7. MANUFACTURERS

2.7.1. The following are acceptable manufacturers:

.1 Schneider Electric

.2 Eaton Cutler-Hammer

.3 Siemens

3. Execution

3.1. INSTALLATION

3.1.1. Install circuit breakers as indicated.

END OF SECTION 16477

1. General

1.1. WORK INCLUDED

1.1.1. Conform to Section 16010 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

1.2. REFERENCES

1.2.1. CSA C22.2 No. 248-00 – Low Voltage Fuses.

1.3. SHOP DRAWINGS AND PRODUCT DATA

1.3.1. Submit Shop Drawings and product data in accordance with Section 16010 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

1.3.2. Submit fuse performance data characteristics for each fuse type and size above 100 A. Performance data to include: average melting time-current characteristics, I2t (for fuse coordination), and peak let-through current.

1.4. MAINTENANCE MATERIALS

1.4.1. Three spare fuses of each type and size installed 600 A and above.

1.4.2. Six spare fuses of each type and size installed up to and including 400 A.

1.5. DELIVERY AND STORAGE

1.5.1. Ship fuses in original containers.

1.5.2. Do not ship fuses installed in switchboard.

1.5.3. Store fuses in original containers in moisture free location.

2. Products

2.1. FUSES GENERAL

2.1.1. Fuse type references L1, L2, J1, R1 etc. have been adopted for use in this specification.

2.1.2. Fuses: product of one manufacturer.

2.1.3. Fuses to have an indicating window to identify when the fuse has been blown.

2.2. FUSE TYPES

2.2.1. Class L fuses.

.1 Type L1, time delay, capable of carrying 500% of its rated current for 10 s minimum.

.2 Type L2, fast acting.

2.2.2. Class J fuses.

.1 Type J1, time delay, capable of carrying 500% of its rated current for 10 s minimum.

.2 Type J2, fast acting.

2.2.3. Class R fuses. For UL Class RK1 fuses, peak let-through current and I2t values not to exceed limits of UL 198E-1982, table 10.2.

.1 Type R1, (UL Class RK1), time delay, capable of carrying 500% of its rated current for 10 s minimum, to meet UL Class RK1 maximum let-through limits.

.2 Type R2, time delay, capable of carrying 500% of its rated current for 10 s minimum.

.3 Type R3, (UL Class RK1), fast acting Class R, to meet UL Class RK1 maximum let-through limits.

2.2.4. Class C fuses.

2.2.5. Fuses for Motors:

.1 All fuses for motor loads are to be time-delay type.

2.3. FUSE STORAGE CABINET

2.3.1. Fuse storage cabinet, manufactured from 2.0 mm (5/64 in.) thick aluminum 750 mm (2 ft. 6 in.) high, 600 mm (2 ft.) wide, 300 mm (1 ft.) deep, hinged, lockable front access door finished in accordance with Section 16010 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

2.4. FUSE PULLER

2.4.1. Provide a fuse puller for each size of fuse to be located in the fuse storage cabinet. Fuse puller to be clearly labelled for the appropriate building and fuse cabinet. Fuse puller to be equal to the Ideal Safe-T-Grip Fuse Puller

2.5. MANUFACTURERS

2.5.1. The following are acceptable manufacturers:

.1 Ferraz Shawmut

.2 Cooper-Bussman

.3 Littelfuse

3. Execution

3.1. INSTALLATION

3.1.1. Install fuses in mounting devices immediately before energizing circuit.

3.1.2. Ensure correct fuses fitted to physically matched mounting devices.

.1 Install Class R rejection clips for Class R fuses.

3.1.3. Ensure correct fuses fitted to assigned electrical circuit.

3.1.4. Where UL Class RK1 fuses are specified, install warning label "Use only UL Class RK1 fuses for replacement" on equipment.

END OF SECTION 16478

1. General

1.1. SUMMARY

1.1.1. The specifications in this section describe the electrical and mechanical requirements for a protection system provided by high-energy Surge Protective Devices (SPD) formally called Transient Voltage Surge Suppressors (TVSS). The specified system shall provide effective, high-energy surge current diversion and be suitable for application in ANSI/IEEE C62.41 Category A, B and C environments.

1.1.2. SPDs are designed for repeated limiting of transient voltage surges on 60 Hz Power circuits not exceeding 1000V and designated as follows:

.1 Type 2 – SPDs hard-wired to distribution equipment after the load side of the service equipment overcurrent device.

.2 Type 3 – Plug-in SPDs.

.3 Type 4 – Component SPDs and component assemblies..

1.2. WORK INCLUDED

1.2.1. Conform to Section 16010 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

1.2.2. Section 16421 – SWITCHBOARDS.

1.2.3. Section 16471 – PANELBOARDS – BREAKER TYPE.

1.2.4. Section 16472 – PANELBOARDS – SWITCH AND FUSE TYPE.

1.3. STANDARDS

1.3.1. The specified system shall be designed, manufactured, tested and installed in compliance with the following codes and standards:

.1 Institute of Electrical and Electronic Engineers (ANSI/IEEE)

.1 C62.11 Standard for Metal-Oxide Surge Arresters for AC Power Circuits (>1 kV), C62.41.1 Guide on the Surge Environment in Low-Voltage (1000V and Less) AC Power Circuits.

.2 C62.41.2 Recommended Practice on Characterization of Surges in Low-Voltage (1000V and Less) AC Power Circuits.

.3 C62.45 Recommended Practice on Surge Testing for Equipment Connected to Low-Voltage (1000V and Less) AC Power Circuits).

.2 Federal Information Processing Standards Publication 94 (FIPS PUB 94) – Guideline on Electrical Power for ADP Installations.

.3 National Fire Protection Association

.1 75 Standard for The Protection of Information Technology Equipment.

.2 780 Standard for the Installation of Lightning Protection Systems).

.4 Canadian Electrical Code (latest edition)

.5 MIL Standard 220B Method of Insertion Loss Measurement

.6 Underwriters Laboratories UL 1283 and UL 1449 (3rd edition)

.7 Canadian Standards or (cUL)

1.4. ENVIRONMENTAL REQUIREMENTS

1.4.1. The operating temperature range shall be -25 deg. C. to 60 deg. C. (-15 deg. F. to 140 deg. F).

1.4.2. The unit shall be capable of operation up to 3,960 m (13,000 ft.) above sea level.

1.4.3. No appreciable magnetic fields shall be generated.

1.5. SUBMITTALS

1.5.1. Product Data: Provide catalogue sheets and supporting documentation showing:

.1 System voltage.

.2 UL1449 3rd Edition listing.

.3 UL 1449 Voltage Protection Ratings.

.4 UL 1449 I-n rating.

.5 Dimensions showing construction, lifting and support points, and enclosure details.

.6 Per mode and per phase peak surge current ratings.

.7 Modes of discrete suppression circuitry.

.8 Warranty period and replacement terms.

.9 Conductor size, conductor type, and recommended lead length.

1.5.2. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product. Indicate maximum size of circuit breaker or fuse to be connected for each unit.

1.5.3. List and detail all protection systems such as fuses, disconnecting means and protective features.

1.5.4. Provide verification that the SPD device complies with the required UL1449 latest edition, latest revision, and CSA or cUL approvals.

1.5.5. SPD shall have UL 1283 EMI/RFI filtering with minimum attenuation of -40dB at 100 kHz.

1.5.6. For retrofit and side-mounting applications, provide electrical/mechanical drawings showing unit dimensions, weights, installation instruction details, and wiring configuration.

1.5.7. Operation and maintenance manuals shall include details for each SPD shipped.

1.6. DELIVERY, STORAGE AND HANDLING

1.6.1. Equipment shall be handled and stored in accordance with manufacturer's instructions. One (1) copy of manufacturer's instructions shall be included with the equipment at time of shipment.

1.7. QUALITY ASSURANCE AND WARRANTY

1.7.1. The manufacturer shall provide a full ten (10) year warranty from the date of shipment against any SPD part failure when installed in compliance with manufacturer's written instructions and any applicable national or local code.

2. Product

2.1. GENERAL

2.1.1. The SPD shall be listed by CSA or cUL to UL's 1283 and UL's 1449 standards (3rd edition, latest revision), and not merely the components or modules. Listing must be verified by a third party approved laboratory.

2.1.2. The SPD shall be CSA or cUL/UL 1449 labelled with 200kA Short Circuit Current Rating (SCCR). Fuse ratings shall not be considered in lieu of demonstrated withstand testing of SPD.

2.1.3. Every suppression component of every mode, including N-G, shall be protected by internal overcurrent and thermal overtemperature controls. SPDs relying upon external or supplementary installed safety disconnectors do not meet the intent of this specification.

2.1.4. Obtain all surge suppression devices from a single manufacturer.

2.1.5. The maximum continuous operating voltage (MCOV) of all components for solidly grounded systems shall not be less than 125% for a 120V system and 120% for 220 and 240V systems, and 125% for 347 and 600V systems. All components for resistance grounded systems shall have an MCOV not less than 125% of the line-to-line voltage.

2.1.6. All SPD's shall be equipped with a comprehensive monitoring system which shall include a visual panel display providing information on unit status and phase loss/protection loss.

2.1.7. Unit Operating Voltage – Refer to drawings for operating voltage and unit configuration.

2.1.8. The suppression system shall incorporate thermally protected metal-oxide varistors (MOVs) as the core surge suppression component for the service entrance and all other distribution levels. The system shall not utilize silicon avalanche diodes, selenium cells, air gaps, or other components that may crowbar the system voltage leading to system upset or create any environmental hazards.

2.1.9. Protection Modes – The SPD must protect all modes of the electrical system being utilized. The required protection modes are indicated by bullets in the following table:

	Protection Modes			
Configuration	L-N	L-G	L-L	N-G
Wye	●	●	●	●

Delta	N/A	●	●	N/A
Single Split Phase	●	●	●	●
High Leg Delta	●	●	●	●

2.1.10. The SPD shall protect all modes L-G, L-N, L-L, and N-G, have discrete suppression circuitry in L-G, L-N and N-G, and have bidirectional, positive and negative impulse protection. Line-to-neutral-to-ground protection is not acceptable where line-to-ground is specified, and accordingly reduced mode units with suppression circuitry built into only 4 modes are not acceptable. In delta systems, line-to-ground-to-line protection is not acceptable where line-to-line is specified.

2.1.11. Nominal Discharge Current (In) – All SPDs applied to the distribution system shall have a 20kA In rating regardless of their SPD Type (includes Types 2 and 4) or operating voltage. SPD shall be UL 1449 labelled with this kA I-nominal (I-n) rating.

2.1.12. ANSI/UL 1449 3rd Edition Voltage Protection Rating (VPR) – The maximum ANSI/UL 1449 3rd Edition VPR for the device shall not exceed the following:

Modes	208Y/120	480Y/277	600Y/347
L-N; L-G; N-G	700	1200	1500
L-L	1200	2000	2500

2.1.13. Surge Current Capacity – The minimum surge current capacity the device is capable of withstanding shall be as shown in the following table:

Minimum surge current capacity based on ANSI / IEEE C62.41 location category			
Category	Application	Per Phase	Per Mode
C	Service Entrance Locations or distribution equipment rated at 1,000 Amps or more.	300 kA	150 kA
B	Distribution equipment rated less than 1,000 Amps but greater than 400 Amps	200 kA	100 kA
A	Branch Location Panelboards, MCCs, Busway rated at 400 Amps or less	100 kA	50 kA

2.1.14. Internal Fusing - Overcurrent Protection

.1 Every suppression component of every mode, including N-G, shall be protected by internal overcurrent and thermal overtemperature controls. SPDs relying upon external or supplementary installed safety disconnectors do not meet the intent of this specification.

2.1.15. SPD shall be separate from or integral to the electrical equipment. Where an Integral SPD is supplied, unit shall be UL 1449 3rd Edition labelled as Type 1 intended for Type 2 applications without need for external or supplemental overcurrent controls.

2.1.16. The suppressor shall include Form C dry contacts (N.O. or N.C.) for remote monitoring capability.

2.2. CATEGORY C LOCATIONS

2.2.1. Provide SPD on the service entrance equipment or distribution equipment rated at 1,000 Amps or more.

2.2.2. The SPD shall have an internal audible alarm with mute on front cover.

2.2.3. SPD's for service entrance locations shall have a transient event counter with LCD panel display and reset button on the front cover.

2.3. CATEGORY B LOCATIONS

2.3.1. SPDs for distribution equipment rated less than 1,000 Amps but greater than 400 Amps shall be as indicated on project drawings.

2.3.2. The SPD shall have an internal audible alarm.

2.4. CATEGORY A LOCATIONS

2.4.1. SPDs for the branch location panelboards, MCCs, busway rated at 400 Amps or less shall be as indicated on project drawings and panel schedules.

2.4.2. The SPD shall have an internal audible alarm.

2.5. DATA & SIGNAL LINE PROTECTION (FOR 24V APPLICATIONS)

2.5.1. The unit shall have a data transmission rate up to 10.0 Mbps.

2.5.2. Each conductor shall have less than 2.4 ohm of internal series resistance per wire, and each pair of conductors shall have a peak surge current of no less than 10,000 amps per wire (20,000 amps per pair), 8 x 20 us waveform.

2.5.3. SPD Voltage Protection level shall be less than < 46V.

2.5.4. The response time of the components of the unit shall be less than one nanosecond.

2.6. PHONE LINE PROTECTION

2.6.1. The unit shall be listed under UL 497A, Standard for Secondary Protectors for Communications Circuits.

2.6.2. The unit shall have a data transmission rate up to 16.0Mbps.

2.6.3. Each conductor shall have less than 1 ohm of internal series resistance per wire

2.6.4. Each pair of conductors shall have a peak surge current of no less than 200 amps, 8 x 20 us waveform.

2.6.5. The maximum let-through voltage on an IEC 10 x 700 us impulse (2kV/80A) shall be 260 volts tip-ring, 260 volts tip to ground, and 260 volts ring to ground.

2.6.6. The response time of the components of the unit shall be less than one nanosecond.

2.7. ENCLOSURES

2.7.1. All enclosed equipment shall have CSA Type 1 sprinklerproof enclosure, unless otherwise noted.

2.7.2. For integral mounted SPD unit, it should be mounted in separate compartment with separate removable cover. For remote mounted SPD unit provide separate enclosure mounted as near to the electrical equipment as possible.

2.8. MANUFACTURERS

2.8.1. Approved Vendors:

.1 Advanced Protection Technologies

.2 Eaton Cutler-Hammer

.3 International Innovative Systems

.4 Schneider Electric

.5 Siemens

3. Execution

3.1. INSTALLATION

3.1.1. Install the SPD with the conductors as short and straight as practically possible. Gently twist conductors together.

3.1.2. Installer may reasonably rearrange breaker locations to ensure short & straightest possible leads to SPDs.

3.1.3. Follow the SPD manufacturer's recommended installation practice as outlined in the equipment installation manual. The electrical contractor shall ensure that all neutral conductors are bonded to the system ground at the service entrance or the serving isolation transformer prior to installation of the associated SPD.

3.1.4. Main service entrance units shall be installed on a breaker, or, where indicated, shall be installed on a non-fused disconnect switch that meets or exceeds the fault current rating of the switchgear. Size of breaker to be confirmed by manufacturer and coordinated with distribution equipment supplier.

3.1.5. Distribution, branch panel, and motor control center units shall be installed on dedicated circuit breakers. Size of breaker to be confirmed by manufacturer and coordinated with distribution equipment supplier.

3.1.6. The installing contractor shall comply with all applicable codes.

END OF SECTION 16480

1. General

1.1. WORK INCLUDED

1.1.1. Conform to Section 16010 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

1.1.2. Section 16031 – SUBMITTALS – SHOP DRAWINGS.

1.1.3. Section 16122 – WIRES AND CABLES.

1.2. REFERENCES

1.2.1. CSA C22.2 No. 74 – Equipment for Use with Electric Discharge Lamps.

1.2.2. The Consortium of Energy Efficiency (CEE) guidelines.

1.2.3. IESNA LM-79 and LM-80.

1.2.4. The Certified Ballast manufacturers Association (CBM) standards.

1.3. SUBSTITUTION

1.3.1. The lighting equipment for this project and specified herein has been carefully selected for its ability to meet the project's luminous environment requirements. Manual and computer calculations have been performed to ensure that the lighting equipment that has been specified complies with established criteria. The Consultant reserves the right not to accept any alternates or substitutions. If alternates or substitutions are entertained, then it is the responsibility of the Contractor/Supplier to provide all information required herein and detailed layouts and lighting calculations demonstrating the performance of the alternate luminaire meets or exceeds the original lighting design while not consuming any additional energy. The Contractor/Supplier is responsible to ensure the light levels provided in the alternate submittal package are achieved. Where the light levels are not achieved, the Contractor is responsible to replace the luminaire with a fixture that will meet the required levels with no increase in energy use at no cost to the Owner. Rather than replacing the fixtures, the Consultant may accept the installation of additional fixtures by the Contractor at no cost to the Owner in order to achieve the required light levels.

1.4. SHOP DRAWING AND PRODUCT DATA

1.4.1. Submit Shop Drawings in accordance with SECTION 16031 – SHOP DRAWINGS.

1.4.2. Submit a shop drawing for each luminaire specified, including lamp.

1.4.3. Luminaire submittals are to consist of a physical description, manufacturer's specification sheets, dimensioned drawings, and complete photometric data from an independent test laboratory in the form of IES computer files of the equipment being submitted and hard copy of the photometric report. Coordinate ceiling types to ensure proper supports and luminaire framing. Lamp submittals are to consist of manufacturer's technical data with respective luminaire shop drawing. Submittal to include operating wattage, rated life, colour temperature,

base type, lamp shape, CRI, and voltage. It must be submitted with a photometric modeling of the space with average, maximum, minimum and max to min values.

1.4.4. Lamp submittals are to consist of manufacturer's technical data with respective luminaire shop drawing. Submittal to include operating wattage, rated life, colour temperature, base type, lamp shape, CRI, voltage and mercury content.

1.4.5. Ballast submittals are to consist of manufacturer's technical data with respective luminaire shop drawing. Submittal to include operating wattage, input voltage, ballast efficiency, maximum distance for remote ballasts, power factor, and operating temperature.

1.4.6. Where samples are indicated on the luminaire schedule, they are to be provided with shop drawings at time of shop drawing submittals unless noted otherwise.

2. Product

2.1. GENERAL

2.1.1. All products must be CSA or CUL approved.

2.2. LAMPS

2.2.1. All Lamps are to meet the standards of the Consortium of Energy Efficiency (CEE) guidelines.

2.2.2. Not all lamps could be used, refer to luminaire schedule for project specific details.

2.2.3. Incandescent, tungsten halogen, high intensity discharge, compact fluorescent and linear fluorescent lamps shall be manufactured by Osram/Sylvania, unless indicated otherwise on luminaire schedule. Lamps are to be in accordance with the lamp specifications detailed in the Luminaire Schedule and as noted below. Luminaire schedule shall take precedence where differences occur.

2.2.4. All lamps are to be new and are to be from the same batch to avoid colour differences. Replace lamps that exhibit colour shift or lumen intensity has prematurely declined at no cost to the owner.

2.2.5. Halogen

.1 Halogen lamp rated life shall be minimum 5,000 hours at rated voltage. All MR16 lamps shall be "Constant Colour" or "IR (Infrared) reflective".

.2 Dichroic reflector lamps are to be provided with glass lens and shall not have spill at back of lamp unless noted in the luminaire schedule. Beam pattern and spread are as indicated on luminaire schedule.

2.2.6. Linear Fluorescent

.1 Linear T5 fluorescent lamps shall have a minimum average rated life of 20,000 hours. The peak lumen output will be at 35 deg. C. The CRI shall be 85 or better and the colour temperature will be 3500 deg. K. unless noted otherwise on the luminaire schedule. Lamp wattage as noted on Luminaire Schedule.

.2 Linear T8 fluorescent lamps shall have a minimum average rated life of 20,000 hours. The peak lumen output will be at 35 deg. C. The CRI shall be 85 or better and the colour temperature will be 3500 deg. K. unless noted otherwise on the luminaire schedule. Lamp wattage as noted on Luminaire Schedule.

.3 All linear fluorescents must be low content mercury lamps. The Standard of acceptance are Sylvania “Ecologic XP” for T8 lamps, Sylvania “Pentron” for T5 lamps.

2.2.7. Compact Fluorescent

.1 Compact fluorescent lamps are to be single end 4-pin with amalgam technology (lower mercury content) and shall have a minimum average rated life of 16,000 hours. The CRI shall be 82 or better and the colour temperature will be 3500 deg. K. unless noted otherwise on the luminaire schedule. Lamp wattage as noted on Luminaire Schedule, 32W compact fluorescents must not be used with of controls or sensors due performance issues.

2.2.8. High Intensity Discharge (HID)

.1 Metal halide lamps shall have a minimum 10,000 hour life and a minimum CRI of 60.

.2 Ceramic Metal halide lamps shall have a minimum 9,000 hour life and a minimum CRI of 81.

.3 All metal halide lamps must be low content mercury lamps.

2.3. BALLASTS

2.3.1. All Ballasts are to comply with CSA C22.2 No. 74 and are to meet or exceed the standards of the Certified Ballast manufacturers Association (CBM).

2.3.2. Not all ballasts could be used, refer to luminaire schedule for project specific details.

2.3.3. All ballasts shall be manufactured by Osram/Sylvania, unless indicated otherwise. Ballasts shall operate at voltage and control lamps as noted in the Luminaire Schedule.

2.3.4. Ballasts for T5 and T8 lamps will be programmed rapid start, will start at minimum 0 deg. C. (indoors) and minus 29 deg. C. (outdoors). Ballasts shall meet ANSI C62.41 Category A transient voltage protection requirements. PF shall be greater than .95, and shall meet FCC Class A specifications for EMI/RFI. The maximum case temperature will not exceed 70 deg. C.

2.3.5. Ballasts for compact fluorescent lamps to be universal input type electronic with end-of-lamp sensing. PF shall be greater than .98, BF shall be greater than .98, THD < 10%. Ballasts shall meet FCC Class A specifications for EMI/RFI.

2.3.6. Ballasts for HID lamps will be suitable for operation in 40 deg. C. temperatures, with a minimum starting temperature of minus 30 deg. C. at 90 % of line voltage. They shall be encapsulated in a steel enclosure. Insulation is to be Class H (minimum 180 deg. C.) vacuum impregnated with silica filled polyester compound. Coils are to be precision or bobbin wound. Sound rating is to be minimum class B. Continuous operation for 60,000 hours at maximum rated load and temperature. Ballast factor of 1.0, .95 minimum power factor, 1.8 minimum crest factor.

2.3.7. Ballasts shall contain no PCB’s and audible rating will be class A or better.

2.3.8. Racks are to be provided for remote ballasts.

2.3.9. Ballasts with unacceptable noise levels are to be replaced at no cost to the owner.

2.4. LUMINAIRES

2.4.1. All luminaires are to be complete with mounting brackets, transformers, supports, trims, louvers, lenses and other accessories as required to make luminaire operational and allow it to be installed in the respective location.

2.4.2. Fixtures shall be suitable for environment, sealed and gasketted with corrosion resistant baked-on finish.

2.4.3. Louvers, lenses and diffusers must be of suitable thickness to prevent sagging.

2.4.4. Poles and bases are to be designed to accommodate wind conditions to avoid damage due to wind-induced vibrations. Shop drawings are to be signed by a structural engineer registered in the local jurisdiction. Flat lens are our standard of acceptance.

2.4.5. The supply and installation of CASH ALLOWANCE luminaires to comply with all standards set forth in Electrical specifications. CASH ALLOWANCE excludes applicable taxes and includes lamps and distributor markups. Under base contract, Electrical Contractor is responsible for delivery, scheduling, receiving, storage, partial assembly, installation, wiring, aiming, cleaning and warranties for all cash allowance items. A separate line item is to include applicable taxes.

2.4.6. The following is a list of generic type designation for luminaires. The project specific luminaire schedule is to be referenced for the specific types and designations and the respective specifications.

.1 Designations beginning with the letter ‘C’ denote compact fluorescent type.

.2 Designations beginning with the letter ‘F’ denote fluorescent type.

.3 Designations beginning with the letter ‘H’ denote high intensity discharge type.

.4 Designations beginning with the letter ‘X’ denote exit light.

3. Execution

3.1. INSTALLATION

3.1.1. The contractor will provide, receive, unload, uncrate, store, protect and install lamps, luminaires, and other related lighting equipment as specified herein. Lamps for all equipment will be provided and installed by the contractor according to equipment manufacturer’s instructions.

3.1.2. Poles and bollards are to be installed on independent concrete bases unless indicated otherwise on the drawings or schedules. Coordinate brackets for cameras and supports for banners with pole manufacturer.

3.1.3. Install remote ballasts in racks and wire fixtures to ballasts in conduit cased on manufacturer’s recommendations.

3.1.4. Locate luminaires in accordance with the Architect's Drawings. Coordinate exact locations on site. Refer to architects drawings for dimensions of coves and valences. . Fluorescent staggered coves must have a minimum of two inches overlap.

3.1.5. Install in accordance with Manufacturer's Instructions, Local Codes, Electrical Division Drawings and Specifications.

3.1.6. Suspend luminaires in mechanical rooms after all the mechanical equipment and ductwork are installed. Luminaires are not to be suspended from mechanical pipes, ductwork or other building services.

3.1.7. For suspended ceiling installations support luminaires from structural slab in accordance with local inspection requirements.

3.1.8. Where luminaires are mounted in tandem, Align luminaires mounted in continuous rows to form straight uninterrupted line.

3.1.9. Align luminaires mounted individually parallel or perpendicular to building grid lines.

3.1.10. Ensure light leakage does not occur from openings and trim rings. Contractor is responsible to repair the ceiling at no cost to the Owner cut-out is too large.

3.1.11. Connect luminaires to lighting circuits.

3.1.12. Provide all wiring in conduit with junction boxes on a grid pattern to limit the run of flexible armoured cable drops from the ceiling mounted junction box to each luminaire to a maximum of 3 m (10 ft.) in length unless approved otherwise in writing from the consultant.

3.1.13. Modular wiring systems shall be employed only where indicated or with approval of the Consultant.

3.1.14. Luminaires are not to be used as temporary construction lighting. After being tested to ensure acceptable operation, luminaires will not be used until substantial completion unless permission is received from the owner, architect or consultant.

3.1.15. Lamps are to be installed after luminaire is cleaned. All fluorescent lamps shall be run through a minimum of 12 hours initial start to increase the lamp life and all lamps shall be run through a minimum of 100 hours initial start prior to any dimming.

3.1.16. Clean all luminaires, inside and out at time of substantial completion. Replace all scratched or damaged luminaires, lenses, louvers and diffusers at no cost to the owner.

3.1.17. Installation of exit signs

.1 Rough-in and installation of exit signs shall be carefully coordinated on site such that after installation of all equipment/services, including equipment/services from other trades (i.e. sprinkler lines, plumbing pipes, way-finding signs, etc), shall not interfere with the line-of-sight visibility of the exit sign(s) from approach of the intended egress pathway(s).

.2 If exit sign(s) have been installed and do not meet the satisfaction of the Consultant/Architect, the Contractor shall lower, raise or relocate the exit sign(s) such that proper and adequate visibility of the exit sign(s) is achieved at no additional cost to the Owner."

END OF SECTION 16505

1. General

1.1. WORK INCLUDED

1.1.1. Conform to Section 16010 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

1.2. REFERENCES

1.2.1. CSA Standard C22.2N0.141-02.

1.3. SHOP DRAWINGS AND PRODUCT DATA

1.3.1. Submit shop drawings for equipment and accessories specified in this Section. Include photometric data for all luminaries not named as approved in this specification.

1.3.2. Data to indicate system components, mounting method, source of power and special attachments.

1.3.3. Manufacturer/Contractor to ensure runtime capacity of battery unit is sized accordingly to meet the runtimes specified within this section and/or drawings/schedules.

1.4. WARRANTY

1.4.1. For batteries, the warranty period shall be extended to 120 months, with a no-charge replacement during the first 5 years and a pro-rata charge on the second 5 years.

2. Products

2.1. EQUIPMENT

2.1.1. Supply voltage: 120 V, ac.

2.1.2. Output voltage: 24 V dc.

2.1.3. Operating time: 30 minutes, unless otherwise noted in schedules.

2.1.4. Battery 10 year sealed, valve regulated, load calcium.

2.1.5. Charger: solid state, multi-rate, voltage/current regulated, inverse temperature compensated, short circuit protected with regulated output of plus or minus 0.01 V for plus or minus 10% input variations. Recharges battery within 24 hours in accordance with CSA.

2.1.6. Solid state transfer circuit.

2.1.7. Low voltage disconnect: solid state, modular, operates at 80% battery output voltage.

2.1.8. Signal lights: solid state, for 'AC Power ON' and 'High Charge'.

2.1.9. Lamp heads: integral on unit and remote as indicated, 345 horizontal and 180 vertical adjustment. Lamp type: MR16, wattage to be 50W unless noted otherwise on drawings or in the “Battery Unit Schedule” (i.e. 35W, 50W).

2.1.10. Directional remote head lamps to have narrow beam spread distribution.

2.1.11. Recessed remote head lamps to have flood beam spread distribution.

2.1.12. Cabinet: suitable for direct or shelf mounting to wall and c/w knockouts for conduit. Removable or hinged front panel for easy access to batteries.

2.1.13. Finish: Baked white enamel.

2.1.14. Auxiliary equipment:

.1 Ammeter.

.2 Voltmeter.

.3 Automatic testing.

.4 Time delay relay.

.5 Battery disconnect device.

.6 ac input and dc output terminal blocks inside cabinet.

.7 Bracket.

.8 Cord and single twist-lock plug connection for ac.

.9 RFI suppressors.

2.2. WIRING OF REMOTE HEADS AND EXIT SIGNS

2.2.1. Conduit: type EMT.

2.2.2. Conductors: XLPE, sized as per manufacturer’s recommendation and compliant to the applicable electrical codes.

3. Execution

3.1. INSTALLATION

3.1.1. Install unit equipment and remote mounted fixtures. Interconnect all heads with central battery pack.

3.1.2. Direct heads to optimize illumination of egress pathways to minimum OBC requirements.

3.1.3. Connect exit lights to unit equipment.

3.1.4. Contractor is to include the supply and installation of one additional head or an additional 5% of the total number of heads shown on the drawings, whichever is greater in the bid price. The installation is to include all wiring and conduit required to install the heads. If the heads are not installed during construction then the spare heads are to be turned over to the Owner at the end of the project.

3.2. TESTING AND COMMISSIONING

3.2.1. Contractor shall commission and test the entire system and adjust as necessary.

3.2.2. Trip breaker(s) feeding battery unit(s) to simulate power failure to building. Test the operation of each unit to document the duration of runtime. Testing shall be performed during non-daylight hours.

3.2.3. Inform Consultant 10 days in advance prior to testing being performed in order for Consultant to make arrangements to witness testing of emergency lighting system.

3.2.4. Provide Consultant with signed test report by Contractor that each unit successfully operated for the required duration of time.

3.2.5. Re-test voltage of battery units 24 hours after initial testing to verify rated nominal voltage of unit. If battery unit has not recharged properly, replace unit and re-test as stated above at no additional cost to Owner.

END OF SECTION 16536

1. General

1.1. WORK INCLUDED

1.1.1. Conform to Section 16010 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

1.2. REFERENCES

1.2.1. IEC 947-4-1 1990, Part 4: Contactors and motor-starters.

1.2.2. Specification Section 16010 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS for Finishes and Identification.

1.3. SHOP DRAWINGS AND PRODUCT DATA

1.3.1. Submit Shop Drawings in accordance with Section 16010 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

.1 Indicate:

.1 Mounting method and dimensions.

.2 Starter size and type.

.3 Layout of identified internal and front panel components.

.4 Enclosure types.

.5 Wiring diagram for each type of starter.

.6 Interconnection diagrams.

1.4. OPERATION AND MAINTENANCE DATA

1.4.1. Provide operation and maintenance data for motor starters for incorporation into manual.

1.4.2. Include operation and maintenance data for each type and style of starter.

1.5. MAINTENANCE MATERIALS

1.5.1. Provide listed spare parts for each different size and type of starter:

.1 Stationary contacts.

.2 Movable contacts.

.3 Auxiliary contacts.

.4 Control transformer.

.5 Operating coil.

.6 Fuses.

.7 Indicating lamp bulbs used.

2. Products

2.1. MATERIALS

2.1.1. Starters: to IEC 947-4 with AC4 utilization category.

2.2. EQUIPMENT

2.2.1. All starters (with the exception of manual motor starters) are to be combination starters with fusible disconnect switches.

.1 All fusible disconnects are:

.1 To be of the quick make and quick break type.

.2 To have an operating handle on the outside of the enclosure.

.3 To have fuse clips suitable for HRC type J fuses.

.2 The operating handle of the fusible disconnect switch must be:

.1 Capable of being locked in the “OFF” position.

.2 Have provisions of accepting 3 pad locks.

.3 Have provision for preventing switching to "ON" position while enclosure door is open.

2.2.2. All starters, with the exception of manual motor starters, are to be provided with a single phase, dry type control circuit transformers with:

.1 A fused secondary.

.2 Primary voltage as indicated.

.3 120V secondary.

.4 Secondary fusing.

2.2.3. Size the control transformer for control circuit load plus 20% spare capacity, minimum capacity 150 VA.

2.2.4. All starters are to equipped with indicating lamps that are long life cluster LED style or long life (10000 hour) incandescent type.

2.2.5. All starters are to be provided with 3 phase bimetallic overload relays which are adjustable and are ambient temperature compensated. Manual resets for the overload relays are to be mounted on the enclosure door such that they can be reset from outside of the enclosure and have externally visible trip indication.

2.2.6. All starters are to have identification for each wire and terminal for external connection, within starter, with permanent number marking identical to diagram.

2.3. MANUAL MOTOR STARTERS

2.3.1. Single or three phase manual motor starters of size, type, rating, and enclosure type as indicated, with components as follows:

.1 Switching mechanism, quick make and break.

.2 One overload heater per phase, manual reset, trip indicating handle.

2.3.2. Accessories:

.1 Toggle switch: heavy duty oil tight labeled as indicated on the Starter Schedule.

.2 Indicating light: oil tight type and colour as indicated on the Starter Schedule.

.3 Locking tab to permit padlocking in "ON" or "OFF" position.

2.4. FULL VOLTAGE MAGNETIC STARTERS

2.4.1. Magnetic and combination magnetic starters of size, type, rating and enclosure type as indicated with components as follows:

.1 Contactor solenoid operated, rapid action type.

.2 Motor overload bimetalic protective relay.

.3 Wiring and schematic diagram inside starter enclosure in a visible location.

2.4.2. Accessories:

.1 Pushbuttons or Selector switches: heavy duty oil tight labeled as indicated on the Starter Schedule.

.2 Indicating lights: oil tight type and color as indicated on the Starter Schedule.

.3 2-N/C and 2 N/O spare auxiliary contacts unless otherwise indicated on the Starter Schedule.

2.5. FULL VOLTAGE REVERSING MAGNETIC STARTERS

2.5.1. Full voltage reversing magnetic starters of size, type, rating and enclosure type as indicated with components as follows:

.1 Two - 3 pole magnetic contactors mounted on a common base.

.2 Mechanical and electrical interlocks to prevent both contactors from operating at same time.

.3 Motor overload bimetalic protective relay.

.4 Wiring and schematic diagram inside starter enclosure in a visible location.

2.6. ACCESSORIES

.1 Pushbuttons or Selector switches: heavy duty oil tight labeled as indicated on the Starter Schedule.

.2 Indicating lights: heavy duty oil tight type and color as indicated on the Starter Schedule.

.3 Auxiliary control devices as indicated on the Starter Schedule.

2.7. MULTI-SPEED STARTERS

2.7.1. (2) speed starters of size, type, rating and enclosure type as indicated. Starter suitable for variable torque type motor, unless otherwise indicated, and with components as follows:

.1 One-3 pole contactor for each winding for separate winding motors.

.2 One-3 pole and one-5 pole contactor for each reconnectable winding for consequent pole type motors.

.3 Three overload relays.

2.7.2. Accessories:

.1 Pushbuttons or Selector switches: heavy duty oil tight labeled as indicated on the Starter Schedule.

.2 Indicating lights: heavy duty oil tight, type and color as indicated on the Starter Schedule.

.3 Auxiliary control devices as indicated on the Starter Schedule.

.4 Low speed compelling relay and automatic sequence accelerating, decelerating relays for each speed.

2.8. MAGNETIC STARTER, REDUCED VOLTAGE, AUTO-TRANSFORMER

2.8.1. Auto-transformer starter closed circuit transition type, of size, type, rating and enclosure type as indicated and with following components:

.1 Three-3 pole contactors.

.2 Auto-transformer with 50%, 65% and 80% taps.

.3 One adjustable pneumatic timing relay.

.4 One-3 pole manual reset overload device.

.5 Thermal overload protection of auto- transformers.

2.8.2. Accessories:

.1 Pushbuttons or Selector switches: heavy duty oil tight labeled as indicated on the Starter Schedule.

.2 Indicating lights: heavy duty oil tight type and color as indicated on the Starter Schedule.

.3 Auxiliary control devices as indicated on the Starter Schedule.

2.9. MAGNETIC STARTER REDUCED VOLTAGE STAR-DELTA

2.9.1. Reduced voltage star-delta open transition starter, of size, type, rating and enclosure type as indicated, with components as follows:

.1 Two-3 pole delta contactors with auxiliary relays and interlocks.

.2 One-3 pole star contactor with auxiliary relays and interlocks.

.3 Mechanical interlock to interlock one delta contactor and the star contactor.

.4 One timing relay.

.5 Three pole overload relays.

2.9.2. Reduced voltage star-delta closed transition starter, of size, type, rating and enclosure type as indicated, with components as follows:

.1 Two-3 pole delta contactors with auxiliary relays and interlocks.

.2 One-3 pole star contactor with auxiliary relay and interlocks.

.3 One-3 pole transition contactor.

.4 One set of transition resistors.

.5 Mechanical interlock, to interlock one delta contactor and the star contactor.

.6 One timing relay.

.7 Three pole overload relays.

2.9.3. Accessories:

.1 Pushbuttons or Selector switches: heavy duty oil tight labeled as indicated on the Starter Schedule.

.2 Indicating lights: heavy duty oil tight, type and color as indicated on the Starter Schedule.

.3 Auxiliary control devices as indicated on the Starter Schedule.

2.10. MAGNETIC STARTER REDUCED VOLTAGE PART WINDING

2.10.1. Two-step reduced voltage, part winding starter of size, type, rating and enclosure type as indicated, with components as follows:

.1 Two-3 pole contactors.

.2 Adjustable pneumatic timer.

.3 Six [manual] [automatic] reset overload relays.

2.10.2. Three step reduced voltage part winding starter of size, type, rating and enclosure type as indicated, with the following components:

.1 Three-3 pole contactors.

.2 One set starting resistors.

.3 Six overload relays.

2.10.3. Accessories:

.1 Pushbuttons or Selector switches: heavy duty oil tight labeled as indicated on the Starter Schedule.

.2 Indicating lights: heavy duty oil tight type and color as indicated on the Starter Schedule.

.3 Auxiliary control devices as indicated on the Starter Schedule.

2.11. THREE PHASE MANUAL REVERSING STARTER

2.11.1. Three phase manual reversing starter of size, type, rating and enclosure type as indicated, with components as follows:

.1 Two-3 pole manual motor starters, quick make and break.

.2 Six overload relays and manual reset.

.3 Mechanical interlock to prevent both switches from closing at same time.

2.11.2. Accessories

.1 Pushbuttons or Selector switches: heavy duty oil tight labeled as indicated on the Starter Schedule.

.2 Indicating lights: heavy duty oil tight type and colour as indicated on the Starter Schedule.

2.12. THREE PHASE MANUAL TWO SPEED SEPARATE WINDING STARTERS

2.12.1. Three phase manual two speed separate winding starters of size, type, rating and enclosure type as indicated with components as follows:

.1 Two-3 pole manual motor starters, quick make and break.

.2 Six overload relays and manual reset.

.3 Mechanical interlock to prevent both switches from closing at same time.

2.12.2. Accessories:

.1 Pushbuttons or Selector switches: heavy duty oil tight labeled as indicated on the Starter Schedule.

.2 Indicating lights: heavy duty oil tight type and colour as indicated on the Starter Schedule.

2.13. ENCLOSURE

2.13.1. Starter to come in a CSA Enclosure 2 sprinkler proof, size as indicated.

2.13.2. Equipment to be painted: baked grey enamel.

3. Execution

3.1. INSTALLATION

3.1.1. Install starters, connect power to starter and control and provide wiring from starter to motor through a manual disconnecting device if required by code.

3.1.2. Coordinate with Mechanical Division Contractor to ensure correct fuses and overload devices elements installed.

3.2. FIELD QUALITY CONTROL

3.2.1. Perform tests in accordance with Section 16010 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS and manufacturer's instructions.

3.2.2. Operate switches, contactors to verify correct functioning.

3.2.3. Perform starting and stopping sequences of contactors and relays.

3.2.4. Check that sequence controls, interlocking with other separate related starters, equipment, control devices, operate as indicated.

END OF SECTION 16811

PANEL: RP-1C

PROJECT NAME: CEDARVALE - NEW ADDITIONS

PROJECT #: 10258.001.E.003

LOCATION: TEACHERS ROOM

FED FROM: MAIN PANELBOARD

Smith + Andersen

TYPE/ INFO	DESCRIPTION	D.F [%]	CONN. LOAD [W]	DEMAND LOAD [W]	BKR [A]	CCT NO.	Φ	CCT NO.	BKR [A]	DEMAND LOAD [W]	CONN. LOAD [W]	D.F [%]	DESCRIPTION	TYPE/ INFO
	EMERGENCY LIGHTING	100	200	200	15	1	A	2	15	200	200	100	TEACHERS ROOM LIGHTING	
	CLASSROOM LIGHTING	100	1000	1000	15	3	B	4	15	1000	1000	100	HALLWAY & STOCK ROOM LIGHTING	
	CLASSROOM LIGHTING	100	1000	1000	15	5	C	6	15	1000	1000	100	CLASSROOM LIGHTING	
	CLASSROOM LIGHTING	100	1000	1000	15	7	A	8	15	350	350	100	TEACHERS ROOM RECEPTACLES	
	CLASSROOM RECEPTACLES	80	450	360	15	9	B	10	15	320	400	80	RECEPTACLES	
	CLASSROOM RECEPTACLES	80	400	320	15	11	C	12	15	320	400	80	CLASSROOM RECEPTACLES	
	CLASSROOM RECEPTACLES	80	400	320	15	13	A	14	15	360	450	80	CLASSROOM RECEPTACLES	
	CLASSROOM RECEPTACLES	80	450	360	15	15	B	16	15	320	400	80	CLASSROOM RECEPTACLES	
	STOCK ROOM RECEPTACLES	80	200	160	15	17	C	18	15	360	450	80	CLASSROOM RECEPTACLES	
	UH-1	80			15	19	A	20	15	800	1000	80	IT RACK RECEPTACLES	
	BOILER PUMP	80			20	21	B	22	15	800	1000	80	IT RACK RECEPTACLES	
		80			2P	23	C	24	15			80	RTU-2	
	SPARE	80			15	25	A	26	↓			80		
	SPARE	80			15	27	B	28	3P			80		
	SPARE	80			15	29	C	30	15			80	ERV-2	
	SPARE	80			15	31	A	32	↓			80		
	SPARE	80			15	33	B	34	3P			100		
	SPARE	100			15	35	C	36	15			100	SPARE	
	SPARE	100			15	37	A	38	15			100	SPARE	
	SPARE	100			15	39	B	40	15			100	SPARE	
	SPARE	100			15	41	C	42	15			100	SPARE	

PANEL OPTIONS:

2	:CSA ENCLOSURE RATING	☐	FLUSH
☐	FEED THROUGH	☒	SURFACE
☐	SUB-FEED	☒	BOLT-ON BREAKER
☐	MAIN BREAKER	☐	SPD
☐	200% RATED NEUTRAL BUS	☐	
☐	ISOLATED GROUND BUS	☐	

LOAD A [KW]:	3.23
LOAD B [KW]:	4.16
LOAD C [KW]:	3.16
TOTAL [KW]:	10.6
CURRENT A [A]:	27
CURRENT B [A]:	35
CURRENT C [A]:	26

PHASE VOLTAGE [V]:	120
LINE VOLTAGE [V]:	208
PHASE:	3Φ
WIRE:	4
MAINS [A]:	225
MAIN BREAKER [A]:	
I.C. [kA]:	10

LEGEND:

BAS-Building Automation System	R.C-Relay Controlled	LTS-Lighting
GFCI-Ground Fault Circuit Interrupter	M-Motor	HID-High Intensity Discharge Lighting Breaker
AFCI-Arc Fault Circuit Interrupter	D.F-Demand Factor	
SPD - Surge Protection Device	REC-Receptacle	D.C-Direct Connection
BLO-Breaker Lock-On Device		

NOTES:

1. Panel Enclosure To Be Sprinklerproof.
2. Panels greater than 66 circuits to be double tub.
3. Surge Protection Device (SPD) to be in a separate barriered enclosure with separate cover.
4. Terminate circuits for BAS in 4"x4" junction box 10' from panel.

PANEL: RP-1G

PROJECT NAME: CEDARVALE - NEW ADDITIONS

PROJECT #: 10258.001.E.003

LOCATION: GYM STORAGE/STAGE AREA

FED FROM: MAIN PANELBOARD

Smith + Andersen

TYPE/ INFO	DESCRIPTION	D.F [%]	CONN. LOAD [W]	DEMAND LOAD [W]	BKR [A]	CCT NO.	Φ	CCT NO.	BKR [A]	DEMAND LOAD [W]	CONN. LOAD [W]	D.F [%]	DESCRIPTION	TYPE/ INFO
	EMERGENCY LIGHTING	100	200	200	15	1	A	2	15	320	400	80	CEILING FANS	
	CHANGE ROOM & GYM STORAGE LTG	100	800	800	15	3	B	4	15	320	400	80	CEILING FANS	
	GYM LIGHTING	100	1150	1150	15	5	C	6	15	450	450	100	EXTERIOR LIGHTING	
	GYM LIGHTING	100	1150	1150	15	7	A	8	20	1300	1300	100	EXTERIOR LIGHTING	
	GYM LIGHTING	100	1150	1150	15	9	B	10	15	160	200	80	STORAGE RECEPTACLES	
	GYM LIGHTING	100	1150	1150	15	11	C	12	15	160	200	80	BEFORE & AFTER CARE RECEPTACLES	
	GYM RECEPTACLES	80	350	280	15	13	A	14	15	240	300	80	EXTERIOR RECEPTACLES	
	GYM RECEPTACLES	80	300	240	15	15	B	16	15	160	200	80	EXTERIOR STORAGE RECEPTACLES	
	STAGE RECEPTACLES	80	300	240	15	17	C	18	30	1500	1875	80	GYM STORAGE BASEBOARD HEATERS	
	PA SYSTEM RECEPTACLE	80	1000	800	15	19	A	20	2P	1500	1875	80		
	PA SYSTEM RECEPTACLE	80	1000	800	15	21	B	22	15	298	372	80	STAGE MOTOR	
	RTU-1	80			40	23	C	24	↓	298	372	80		
		80			↓	25	A	26	3P	298	372	80		
		80			3P	27	B	28	20			80	DIVIDER MOTOR	
	ERV-1	80			15	29	C	30	30			80	NET MOTOR	
		80			↓	31	A	32	30			80	NET MOTOR	
		80			3P	33	B	34	20			100	FUTURE STAGE LIGHTING	
	SPARE	100			15	35	C	36	20			100	FUTURE STAGE LIGHTING	
	SPARE	100			15	37	A	38	20			100	FUTURE STAGE LIGHTING	
	SPARE	100			15	39	B	40	20			100	FUTURE STAGE LIGHTING	
	SPARE	100			15	41	C	42	15			100	SPARE	
	SPARE	100			15	43	A	44	15			100	SPARE	
	SPARE	100			15	45	B	46	15			100	SPARE	
	SPARE	100			15	47	C	48	15			100	SPARE	
	SPARE	100			15	49	A	50	15			100	SPARE	
	SPACE	100				51	B	52				100	SPACE	
	SPACE	100				53	C	54				100	SPACE	
	SPACE	100				55	A	56				100	SPACE	
	SPACE	100				57	B	58				100	SPACE	
	SPACE	100				59	C	60				100	SPACE	

PANEL OPTIONS:

2	:CSA ENCLOSURE RATING	☐	FLUSH
☐	FEED THROUGH	☒	SURFACE
☐	SUB-FEED	☒	BOLT-ON BREAKER
☐	MAIN BREAKER	☐	SPD
☐	200% RATED NEUTRAL BUS	☐	

LOAD A [KW]:	6.09
LOAD B [KW]:	3.93
LOAD C [KW]:	4.95
TOTAL [KW]:	15
CURRENT A [A]:	51

PHASE VOLTAGE [V]:	120
LINE VOLTAGE [V]:	208
PHASE:	3Φ
WIRE:	4
MAINS [A]:	225
MAIN BREAKER [A]:	

PANEL: RP-1G
PROJECT NAME: CEDARVALE - NEW ADDITIONS
PROJECT #: 10258.001.E.003

LOCATION: GYM STORAGE/STAGE AREA

FED FROM: MAIN PANELBOARD

Smith + Andersen

TYPE/ INFO	DESCRIPTION	D.F [%]	CONN. LOAD [W]	DEMAND LOAD [W]	BKR [A]	CCT NO.	Φ	CCT NO.	BKR [A]	DEMAND LOAD [W]	CONN. LOAD [W]	D.F [%]	DESCRIPTION	TYPE/ INFO
☐	ISOLATED GROUND BUS	☐			CURRENT B [A]:				33				I.C. [kA]:	10
					CURRENT C [A]:				41					

LEGEND:

BAS-Building Automation System	R.C-Relay Controlled	LTS-Lighting
GFCI-Ground Fault Circuit Interrupter	M-Motor	HID-High Intensity Discharge Lighting Breaker
AFCI-Arc Fault Circuit Interrupter	D.F-Demand Factor	
SPD - Surge Protection Device	REC-Receptacle	D.C-Direct Connection
BLO-Breaker Lock-On Device		

NOTES:

1. Panel Enclosure To Be Sprinklerproof.
2. Panels greater than 66 circuits to be double tub.
3. Surge Protection Device (SPD) to be in a separate barriered enclosure with separate cover.
4. Terminate circuits for BAS in 4"x4" junction box 10' from panel.

Smith + Andersen
4211 Yonge Street Suite 500 Toronto Ontario M2P 2A9
416 487 8151 f 416 487 9104 smithandandersen.com

COMMUNICATIONS SPECIFICATION

FOR

CEDARVALE COMMUNITY SCHOOL
145 AVA ROAD
YORK, ONTARIO

THIS SPECIFICATION SHALL BE READ IN CONJUNCTION WITH DRAWINGS:

TC-2.0

OUR PROJECT NUMBER:

10258.001.D.001

DATE:

2011-09-02

ISSUED:

TENDER

SECTION	NUMBER	NAME	PAGES
	27 00 05.10	General Instructions for Communications Sections	5
	27 00 05.10	General Instructions for Communications Sections	5
	27 00 05.20	Definitions and Abbreviations	7
	27 00 05.30	Codes, Standards and Regulations	2
	27 00 05.60	Administrative Requirements	3
	27 00 05.70	Project Specific Requirements	3
	27 00 06.00	Fire Stopping and Water Proofing	4
	27 05 26.00	Grounding and Bonding for Communications Systems	5
	27 05 28.00	Pathways for Communications Systems	4
	27 08 00.00	Commissioning for Communications Systems	6
	27 15 00.16	Voice Communications Horizontal Cabling	2
	27 15 00.19	Data Communications Horizontal Cabling	2

END OF SECTION 27 00 00.00

1 GENERAL

1.1 WORK INCLUDED

.1 Conform to the requirements of Division 1, which applies to and forms part of all sections of the work.

.2 Read and comply with all sections of this document.

.3 Read and complete the Communications Tender and Supplementary Tender forms.

.4 The Specification is divided into Sections which are not intended to identify contractual limits between Sub-Contractors nor between the Contractor and his Sub-Contractors. The requirements of any one Section apply to all Sections. Refer to other Divisions and Sections to ensure a complete and operational system.

.5 Provide Communications components and accessories which may not be specifically shown on the Drawings or stipulated in the Specifications, but are required to ensure complete and operational systems.

.6 Provide all labour, materials, tools, and equipment required for the complete installation of work called for in all sections of the Contract Documents.

1.2 SECTIONS AFFECTED

.1 These instructions apply to and form a part of all Communications Sections.

1.3 SCOPE OF WORK

.1 This document is the Specification for the supply and installation of a Communications System for the following project:

Cedarvale Community School
145 Ava Road,
York, Ontario

.2 This project consists of the supply and installation of horizontal UTP cabling to support Voice and Data applications for classrooms, workstations, offices and meeting rooms throughout the premises.

.3 The cabling shall be installed based on the drawing documents provided herewith. In general, horizontal and backbone cable distribution shall be done via Cabling Contractor installed cable slings J-hooks and or conduit.

.4 The Cabling Contractor shall supply and install a complete Structured Cabling Solution based on a physical star wiring topology (unless otherwise specified) that is designed in accordance with and supported by a manufacturer backed certification and warranty as specified herein.

.5 The scope of work shall include but shall not be limited to:

.1 The voice cabling system will be supplied and installed by Bell Canada as part of the Centrex agreement between Bell Canada and the City of Toronto. Bell Canada will have ownership of the voice cabling system. The system will be based on Category 6 wiring and will be provided in accordance with Bell Canada's specifications. There is no cost to the contractor from Bell for this service.

.2 The data cabling system (only applies to horizontal copper cabling between each WAO and the associated Communications Rack in the Server Room) be supplied and installed by Bell Canada as part of the COTTI agreement between Bell Canada and the City of Toronto. The City of Toronto will have ownership of the data cabling system, based on Category 6 wiring.

.3 Cabling Contractor shall supply and install 15 pin female to female VGA cables and connectors (not terminated). Contractor shall terminate all VGA cables on site and will reference communications drawings for exact locations and quantities.

.4 Supply and installation of 4-pair UTP cabling to support end-user Data applications.

.5 Supply and installation of 4-pair UTP cabling to support end-user Voice applications.

.6 Supply and installation of multipair copper cabling to support Voice and/or Data applications over backbone.

.7 For copper cables, Cabling Contractor shall leave a 10 foot slack of cabling in the ladder tray or on j-hooks above the ceiling (where applicable) above the racks/cabinets within the Telecom / Computer Room.

.8 The Cabling Contractor shall assume that the entire installation will be done during regular hours.

.9 Cabling Contractor shall provide to the Communications Consultant one digital copy of shop drawings / engineering specifications for all products prior to purchase to acquire written approval from the Client and / or the Communications Consultant.

.6 While every attempt has been made to ensure all information is correct at the time of publication, the products specified are available and that the part numbers identified are correct, it is the responsibility of the Cabling Contractor to verify all part numbers and to report any errors and/or omissions in this Specification with their bid submissions.

.7 Dimensions shown on Drawings are approximate. Verify dimensions by reference to shop drawings and field measurements.

.8 Quantities or lengths indicated in any of the Contract Documents are approximate only and shall not be held to gauge or limit the work.

.9 Include in bid all labour, materials, plant, transportation, storage costs, training, equipment, insurance, temporary protection, permits, inspections, bonding, taxes and all necessary and related items required to provide complete and operational systems shown and described.

1.4 BIDDER INQUIRIES

.1 Bidders who find discrepancies or omissions in this Specification and accompanying drawings, or who have any doubt as to the technical meaning or intent of any part of this Specification and accompanying drawings, shall direct their questions or other inquiries in writing to:

Tony Santaguida, Project Manager
Smith + Andersen
4211 Yonge Street, Suite 500 Telephone: 416 218-7052
Toronto, Ontario Facsimile: 416 487-9104
M2P 2A9 E-mail: tony.santaguida@smithandandersen.com

.2 In fairness to all bidders, all questions will be answered and distributed to all. Oral questions will not be answered. **No questions will be answered within 48 hours of the closing date / hour of the bid.**

1.5 TENDER FORM AND SUBMISSION OF TENDERS

.1 Submit with Tender all information called for on the Communications Tender and Supplementary Tender Forms. Tenders not completed in full may, at the discretion of the Client, be rejected.

.2 Show separate, identified, alternate and unit prices for optional components or items called for as additions to or deductions from the Tender amount.

.3 The Client reserves the right to accept or reject any substitution without question.

.4 All prices shall include incidental fees and other fees for items required to successfully install the Structured Cabling Solution that may or may not be indicated in this document. Successful installation of the Structured Cabling Solution is one that meets the requirements of this document and meets all telecommunications (and related) standards, municipal, local, Provincial and Federal building, safety, fire and electrical codes.

1.6 HOLDBACK

.1 The value for testing and documentation (cable test results and as-builts), for payment purposes, shall be set at 10% of the base contract or $5,000; which ever is greater. This amount will be withheld from the Cabling Contractor until testing and correction of deficiencies is 100% complete.

1.7 SCHEDULE

.1 The milestone(s) for the schedule in this project are as indicated below. The Cabling Contractor shall meet all indicated dates, however they are subject to change. The Cabling Contractor shall verify with the Project Manager and/or General Contractor all dates as listed below.

Phase	Cut-over Date
1	T.B.D
2	T.B.D

1.8 LABOUR

.1 The Cabling Contractor must comply with all job-site requirements for the duration of the project.

.2 The Cabling Contractor shall not assign or sub-contract any work without the prior **written consent** of the Project Manager. A list of sub-Contractors shall be submitted with the Tender response.

.3 The Cabling Contractor agrees to use only tradesmen who are fully trained, qualified and experienced on the installation, termination and testing of the Structured Cabling Solution. The Cabling Contractor must be a certified installer of the specific Structured Cabling Solution.

1.9 DRAWINGS, CHANGES AND INSTALLATION

.1 The Cabling Contractor, at his expense, shall remedy any work not installed in correct location (at the sole discretion of the Communications Consultant). The Cabling Contractor is responsible to mark-out his work and fully co-ordinate with all other trades. Review with Communications Consultant prior to rough in. Prepare dimensioned layouts of each room prior to rough in for review by Communications Consultant. Do not proceed with any work until the Communications Consultant has reviewed and approved the layout drawings.

1.10 SUBSTITUTIONS

.1 Proposed substitutions in order to be assessed must include the following:

.1 Description of proposed substitution;

.2 Respective cost of items originally specified and the proposed solution;

.3 Compliance with the applicable Building Codes and the requirements of jurisdictional authorities;

.4 Compliance with the applicable telecommunications standards;

.5 Affect concerning compatibility with and interface with adjacent building materials and components;

.6 Compliance with the intent of the Contract Documents;

.7 Reasons for the request.

.2 The Communications Consultant's decision regarding the acceptance or rejection of the proposed substitution shall be final. Substitutions may be accepted if the delivery of the component or item is such that it will not jeopardise the construction schedule. Otherwise substitution will not be allowed.

1.11 EQUIPMENT AND MATERIALS MINIMUM REQUIREMENTS

.1 Materials and equipment supplied by this Division shall be new and free from defects.

.2 All equipment and material for which there is a listing service shall bear a UL/ULC and/or CSA label.

.3 Equipment shall meet all applicable FCC/CRTC Regulations.

.4 Materials shall have a flame spread rating of 25 or less and a smoke developed rating of 50 or less, in accordance with NFPA 255.

1.12 CO-OPERATION WITH OTHER DIVISIONS

.1 Communications cabling shall not touch or be supported from piping, ductwork, conduits, ceiling supports or any other structure / equipment. Communications cabling shall be supported by j-hooks, cable slings (CAT. 425), ladder tray (where provided) or shall be installed within conduit (where provided).

.2 Supply all items to be built in ample time for rapid progress of the work. Schedule and proceed with work as required to satisfy the construction schedule.

1.13 EXISTING SERVICES AND EQUIPMENT

.1 All changes and connections to existing services shall be made only in a manner and at a time approved by the Communications Consultant and/or the Client so as to avoid any interruption of such services during normal working hours. If necessary, changes and connections to existing services shall be made outside of normal working hours, at no extra cost to the Contract.

.2 Where connections are made to existing services, existing fire stopping shall be made good under this Division.

1.14 METRIC CONVERSIONS

.1 Particular care shall be taken with imperial versus S.I. metric conversions. This applies to all services including, but not limited to, equipment, material and site services in both new and existing installations.

.2 Conform to the Canadian Metric Practice Guide CSA-CAN3-2234-1-89.

1.15 SCHEDULE, ACCESS, PROTECTION AND CLEAN-UP

.1 The construction schedule places restrictions on the duration of construction within areas and the duration of shut-down of equipment. Refer to the General Conditions for all requirements.

.2 Access to the site is limited to location and time of day. Access to areas of the building is limited to location and time of day. Refer to the General Conditions and conform to all requirements.

.3 Refer to the security and protection requirements in the General Conditions and conform to all requirements. There shall be no smoking, and the site shall be kept clean at all times.

1.16 CUTTING, PATCHING AND REPAIRING

.1 It is the responsibility of the Cabling Contractor to perform all cutting, patching and repair related to the Communications Cabling work including any penetrations through walls or floors.

1.17 HOISTING FACILITIES

.1 This Division shall provide its own hoisting facilities.

.2 Hoisting facilities provided by the General Contractor may be available for subcontractors' use at no cost (verify with General Contractor prior to bid, or assume that no hoisting facilities are provided). If hoist facilities are inadequate then Communications Contractor shall provide as required. Communications Contractor shall inform General Contractor(s) of requirements before tender closing date.

2 PRODUCTS

2.1 STRUCTURED CABLING SOLUTION

.1 The Cabling Contractor shall supply and install a complete end to end Structured Cabling Solution where the entire Channel is **manufactured, warranted and certified by a single manufacturer**. The Cabling Contractor shall be currently authorised and certified to install and warranty the Solution. If a sub-Contractor is being used for the installation, it is mandatory that the sub-Contractor be currently authorised and certified to install and warranty the Solution.

.2 The Cabling Contractor shall supply and install a complete end to end Structured Cabling Solution from one of the following manufacturers / product lines, and the Cabling Contractor shall be authorised and certified to install and warranty the Solution:

Manufacturer	Certification
Siemon	CI – Certified Installer
Belden	CSV – Certified Systems Vendor
Panduit	PCI - Panduit Certified Installer
Systimax	VAR – Value Added Reseller
Tyco/Amp	ND&I – Netconnect Design and Installation Contractor

3 EXECUTION

3.1 TERMINATION REQUIREMENTS

.1 All cabling must be terminated using EIA/TIA 568A configuration, unless noted otherwise.

3.2 SITE EXAMINATION

.1 Prior to submitting their Tender, the Cabling Contractor shall perform a site survey to become familiar with the site and all conditions of the site affected by the proposed work. No claims for extra payment will be considered because of failure to fulfil this condition.

END OF SECTION 27 00 05.10

1 GENERAL

1.1 DEFINITIONS

.1 Generally, the following definitions are used in this Division:

Addendum	-	Normative document used to provide additional requirements and recommendations to a published document (e.g., standards, contracts). When published, an addendum effectively becomes part of the document that it supports.
Bonding	-	The permanent joining of metallic parts to form an electrically conductive path that will ensure electrical continuity and the capacity to conduct safely any current likely to be imposed.
Bonding Conductor (BC)	-	A conductor used specifically for the purpose of bonding.
Building Entrance Facility	-	The room or space inside a building where telecommunications cables enter and leave the building.
Cabling Contractor	-	The successful bidder to this Specification responsible for the supply and installation of the Structured Cabling Solution.
Category	-	A rating that defines the performance of cabling components and systems. Describes mechanical properties and transmission characteristics of balanced twisted-pair cabling and provides a numbered designation.
Client	-	**Cedarvale Community School**
Communications Consultant	-	Tony Santaguida, Project Manager **Smith + Andersen** 4211 Yonge Street, Suite 500 Toronto, Ontario M2P 2A9
Cut Over	-	The live date(s) when the Client will occupy the space as indicated by date and/or phasing.
Grounded Conductor	-	A system or circuit conductor that is intentionally grounded.
Grounding System	-	A system of hardware and wiring that provides an electrical path from a specified location to an earth ground point.

Modular Copper Patch Panel	-	A patch panel that allows each RJ-45 female jack (or port) to be removed individually.
Project	-	Supply and installation of a complete Structured Cabling Solution to support Voice, Data and/or Video applications as described in this document.
Project Manager	-	TBD
Provide	-	Supply and install.
Workstation	-	Systems Furniture Workstation, Office, Meeting Room, Boardroom, Classroom, etc. Any Voice or Data cable originating in a Telecom, LAN, Computer Room or Consolidation Point that is not terminated on a patch panel / IDC Block at the other end.

1.2 ABBREVIATIONS

.1 Generally, the following abbreviations are used in this Division:

A	-	Ampere
ac	-	Alternating current
ACR	-	Attenuation to Cross-Talk Ratio
ADC	-	Analog to Digital Converter
ADSL	-	Asymmetric Digital Subscriber Line
A/E	-	Architect or Engineer
AFF	-	Above Finished Floor
AHJ	-	Authority Having Jurisdiction
ALPETH	-	Aluminum Polyethylene
AME	-	Architectural, Mechanical, Electrical
AN	-	Access Node
ANSI	-	American National Standards Institute
AP	-	Access Point
ARPAP	-	Resin-coated Aluminum, Polyethylene Aluminum, Polyethylene
ASCII	-	American Standard Code for Information Interchange
ASP	-	Aluminum Steel Polyethylene
ASTM	-	American Society for Testing and Materials
ATD	-	Asynchronous Time Division
ATDM	-	Asynchronous Time Division Multiplexing
ATM	-	Asynchronous Transfer Mode
Attn	-	Attenuation
AV	-	Audiovisual
AWG	-	American Wire Gauge
BAS	-	Building Automation System
BC	-	Bonding Conductor
BCD	-	Backbone Conduit
BCT	-	Bonding Conductor for Telecommunications
BEF	-	Building Entrance Facility
BER	-	Bit Error Rate
BERT	-	Bit Error Rate Test

BFOC	-	Bayonet Fibre Optic Connector
BIC	-	Building Industry Consultant
BICSI®	-	Building Industry Consulting Service International
bit	-	Binary Digit
BOM	-	Bill Of Material
b/s	-	Bit per Second
BWA	-	Broadband Wireless Access
CA	-	Cable
CACSP	-	Coated Aluminum Coated Steel Polyethylene
CAD	-	Computer Aided Design
CATV	-	Community Antenna Television (Cable Television)
CCIA	-	Computer Communications Industry Association
CCTV	-	Closed Circuit Television
CD	-	Compact Disc
CEC	-	Canadian Electrical Code
CEF	-	Cable Entrance Facility
cm	-	Centimetre
CMP	-	Communications Plenum
CMR	-	Communications Riser
coax	-	Coaxial Cable
CO-OSP	-	Customer-Owned Outside Equipment
CP	-	Consolidation Point
CPU	-	Central Processing Unit
CPVC	-	Chlorinated Polyvinyl Chloride
CSA	-	Canadian Standards Institute
CSC	-	Construction Specifications Canada
CSI	-	Construction Specifications Institute
CT	-	Cable Tray
Cu	-	Copper
dB	-	Decibel
dB/km	-	Decibel per Kilometre
dBm	-	Decibel milliwatt
dBmV	-	Decibel millivolt
demarc	-	Demarcation Point
D-ring	-	Distribution Ring
DSL	-	Digital Subscriber Line
EF	-	Entrance Facility
EIA	-	Electronics Industry Alliance
ELFEXT	-	Equal Level Far-End Crosstalk
e-mail	-	Electronic Mail
EMI	-	Electromagnetic Interference
EMI/RFI	-	Electromagnetic Interference / Radio Frequency Interference
ER	-	Equipment Room
ESD	-	Electrostatic Discharge
e/w	-	Equipped With
FC	-	Fibre Connector
FCC	-	Federal Communications Commission
FDDI	-	Fibre Distributed Data Interface
FEP	-	Fluorinated Ethylene Propylene
FEXT	-	Far-End Crosstalk

FOTP	-	Fibre Optic Test Procedure
ft	-	Foot / Feet
ft^2	-	Square Foot / Feet
FTTD	-	Fibre To The Desk
FT 1 / FT 3	-	Fractional T 1 / Fractional T 3
G	-	Giga
Gb	-	Gigabit
GB	-	Gigabyte
Gb/s	-	Gigabit per Second
GC	-	General Contractor
GHz	-	Gigahertz
HC	-	Horizontal Cross-connect
Hz	-	Hertz
I	-	Current
IC	-	Intermediate Closet
IC	-	Intermediate Cross-connect
ID	-	Identification
ID	-	Inside Diameter
IDC	-	Insulation Displacement Connection
IDC	-	Insulation Displacement Connector
IDC	-	Insulation Displacement Contact
IDF	-	Intermediate Distribution Frame
IEEE®	-	Institute of Electrical and Electronics Engineers, Inc.®
IG	-	Isolated Ground
in	-	Inch
in^2	-	Square Inch
I/O	-	Input / Output (Device)
IOR	-	Index Of Refraction
ISDN	-	Integrated Services Digital Network
ISO	-	International Organization for Standardization
IT	-	Information Technology
kb	-	Kilobit
kB	-	Kilobyte
kg	-	Kilogram
Km	-	Kilometre
kV	-	Kilovolt
kVA	-	Kilovoltampere
kW	-	Kilowatt
kWh	-	Kilowatt hour
LAN	-	Local Area Network
laser	-	Light Amplification by Stimulated Emission of Radiation
lb	-	Pound
LED	-	Light Emitting Diode
LSZH	-	Low Smoke Zero Halogen
m	-	Metre
m^2	-	Square Metre
mA	-	Milliampere
MAC	-	Move, Add, or Change
MAN	-	Metropolitan Area Network
Mb	-	Megabit

MB	-	Megabyte
Mb/s	-	Megabit per Second
MB/s	-	Megabyte per Second
MC	-	Main Cross-connect
MDF	-	Main Distribution Frame
MGB	-	Main Grounding Busbar
MHz	-	Megahertz
mi	-	Mile
MIMS	-	Mineral Insulated Metal Sheathed
min	-	Minute
mm	-	Millimetre
MM	-	Multimode
MMF	-	Multimode Fibre
MPP	-	Modular Patch Panel
ms	-	Millisecond
MSDS	-	Material Safety Data Sheet
MUTO	-	Multi-user Telecommunications Outlet
MUTOA	-	Multi-user Telecommunications Outlet Assembly
mW	-	Milliwatt
MW	-	Megawatt
NBCC	-	National Building Code of Canada
NESC	-	National Electrical Safety Code
NEXT	-	Near-end Crosstalk
NIC	-	Network Interface Card
NIR	-	Near-end crosstalk-to-Insertion loss Ratio
NRCC	-	National Research Council of Canada
OD	-	Outside Diameter
OEM	-	Original Equipment Manufacturer
OF	-	Optical Fibre
OSP	-	Outside Plant
PBX	-	Private Branch Exchange
PDU	-	Power Distribution Unit
PSACR	-	Power Sum Attenuation to Crosstalk Ratio
PSELFEXT	-	Power Sum Equal Level Far-End Crosstalk
PSNEXT	-	Power Sum Near-End Crosstalk
PVC	-	Polyvinyl Chloride
QA	-	Quality Assurance
QC	-	Quality Control
QoS	-	Quality of Service
RCDD®	-	Registered Communications Distribution Designer
RF	-	Radio Frequency
RFI	-	Radio Frequency Interference
RJ	-	Registered Jack
rms	-	Root Mean Square
RU	-	Rack Unit (1.75”)
RX	-	Receive
RX	-	Receiver
SAN	-	Storage Access Network
SC	-	Single Fibre Coupling Optical Fibre Connector
SCC	-	Standards Council of Canada

SCS	-	Structured Cabling System
ScTP	-	Screened Twisted Pair
SFTP	-	Screened Foiled Twisted Pair
SI	-	International System of Units (Le Système International d'Unités)
SLA	-	Service level Agreement
SM	-	Singlemode
SMF	-	Singlemode Fibre
SNMP	-	Simple Network Management Protocol
SNR	-	Signal-to-Noise Ratio
STALPETH	-	Steel Aluminum Polyethylene
STP	-	Shielded Twisted Pair
STP-A	-	Shielded Twisted Pair A
T 1	-	Trunk Level 1
TBB	-	Telecommunications Bonding Backbone
TBBIBC	-	Telecommunications Bonding Backbone Interconnecting Bonding Conductor
TC	-	Telecommunications Closet
TDD	-	Telecommunications Device for the Deaf
TGB	-	Telecommunications Grounding Busbar
TGR	-	Telecommunications Grounding Rod
TIA	-	Telecommunications Industry Association
TMGB	-	Telecommunications Main Grounding Busbar
TP	-	Twisted Pair
TR	-	Telecommunications Room
TS	-	Technical Standard
TSB	-	Telecommunications Systems Bulletin (formerly Technical Systems Bulletin)
TTY	-	Teletypewriter / Text Telehone
TV	-	Television
TX	-	Transmit
TX	-	Transmitter
UD	-	Underfloor Duct
UL®	-	Underwriters Laboratories Inc.®
ULC	-	Underwriters Laboratories of Canada
UPC	-	Universal Product Code
UPS	-	Uninterruptible Power Supply
UTP	-	Unshielded Twisted Pair
V	-	Volt
VA	-	Volt-Ampere
VCSEL	-	Vertical Cavity Surface Emitting Laser
VLAN	-	Virtual Local Area Network
VoIP	-	Voice over Internet Protocol
VPN	-	Virtual Private Network
W	-	Watt
WAN	-	Wide Area Network
WAP	-	Wireless Application Protocol
WiFi	-	Wireless Fidelity
Wi-Fi	-	Wireless Fidelity
WLAN	-	Wireless Local Area Network
WMAN	-	Wireless Metropolitan Area Network

WWAN	-	Wireless Wide Area Network
X	-	Cross-connect
XLPE	-	Cross-linked Polyethylene
XPE-PVC	-	Expanded Polyethylene Polyvinyl Chloride

2 PRODUCTS

2.1 NOT USED

3 EXECUTION

3.1 NOT USED

END OF SECTION 27 00 05.20

1 GENERAL

1.1 CODES, STANDARDS AND REGULATIONS COMPLIANCES

.1 The Cabling Contractor shall adhere to all Codes, Standards, Regulations and documents listed throughout this document.

.2 All products installed must meet or exceed all Local, Provincial and Federal Building, Fire, Health, Safety and Electrical Codes.

.3 Non-plenum and plenum rated cables shall be ETL or ULC (UL) Listed and CSA Certified as type CMR / CMP (respectively), in accordance with the Binational Standard for Communications Cable, UL444/C22.2 No. 214-94.

.4 The equipment, material and installation shall conform to the latest version of the applicable Codes, Standards and Regulations of authorities having jurisdiction as indicated in the table below. In the case of conflict or discrepancy the more stringent code, standard or regulation shall apply.

STANDARD	TITLE
ANSI/ICEA	
S-80-576	Communication Cables.
S-83-596-1988	Optical Fibre Premises Distribution Cable.
S-83-640-1992	Optical Fibre Outside Plant Communications Cable.
Z136.2	American Standards for the Safe Operation of Optical Fibre Communication Systems Utilizing Laser Diode and LED Sources.
ANSI/TIA/EIA	
455	Optical Fibre Test Procedures.
472CAAA-93	Detail Specification for All-Dielectric (Construction 1) Optical Fibre Communications Cable for Indoor Plenum Use, Containing Class Ia, 62.5 mm Core Diameter/125 Cladding Diameter Optical Fibre(s).
472DAAA-93	Detail Specification for All-Dielectric Optical Fibre Communications Cable for Outside Plant Use, Containing Class Ia, 62.5 mm Core Diameter/125 mm Cladding Diameter/250 mm Coating Diameter Optical Fibre(s).
492AAAA-98	Detail Specification for 62.5-mm Core Diameter/125-mm Cladding Diameter Class Ia Multimode, Graded-Index Optical Waveguide Fibres.
492AAAB-98	Detail Specification for 50.0-mm Core Diameter/125-mm Cladding Diameter Class Ia Multimode, Graded-Index Optical Waveguide Fibres.
492BAAA-98	Detail Specification for Class IVa Dispersion-Unshifted Singlemode Optical Waveguide Fibres Used In Communications Systems.
568-B.1	Commercial Building Telecommunications Cabling Standard: General Requirements.
568-B.2	Commercial Building Telecommunications Cabling Standard: Balanced Twisted Pair Cabling.
568-B.3	Commercial Building Telecommunications Cabling Standard: Optical Fibre Cabling Components Standard.
569-A-98	Commercial Building Standards for Telecommunications Pathways and Spaces. Including Addenda 1-6.
598-A-95	Optical Fibre Cable Color Coding.
570-91	Residential and Light Commercial Telecommunications Wiring Standard.
604-3	Optical Fibre Connector Intermateability Standard (Focis 3).
606	Administration Standard for the Telecommunications Infrastructure of Commercial Buildings.
607-A	Commercial Building Grounding and Bonding Requirements for Telecommunications.
758	Customer Owned Outside Plant Telecommunications Cabling Standard.
942	Telecommunications Infrastructure Standard for Data Centres
CSA	
C21.1-98	Canadian Electric Code Part I: Safety Standards for Electrical Installations.
C21.2 No. 181.4-M90	Plugs, Receptacles, and Connectors for Communication Systems.
C21.2 No. 214-94	Communications Cables.
C21.2 No. 0-M91	Canadian Electric Code Part II: General Requirements (Communications Cables).
C21.2 232 M1998	Canadian Electric Code Part II: Optical Fibre Cables.
T527-94	Grounding and Bonding for Telecommunications in Commercial Buildings.
T528-93	Design Guidelines for Administration of Telecommunications Infrastructure in Commercial Buildings.
T529-95	Design Guidelines for Telecommunications Wiring Systems in Commercial Buildings.
T530-M90	Building Facilities, Design Guidelines for Telecommunications.

OTHER	
CAN/ULC S115	Standard Method of Fire Tests of Firestop Systems.
CAN/ULC S101	Standard Method of Fire Endurance Tests of Building Construction and Materials.
CAN/ULC S102	Standard Method of Testing for Surface Burning Characteristics of Building Materials and Assemblies.
CEC, Part 1	The Canadian Electrical Code, Part 1.
CENELEC EN 50173	Performance Requirements for Generic Cabling Schemes.
FIPS PUB 174	Commercial Building Telecommunications Wiring Standard. Federal Information Publication Standard.
ICEA S-90-661	Individually Unshielded Twisted Pair Indoor Cable for Use in Communications Wiring Systems.
IEEE Std 1100	IEEE Recommended Practice for Powering and Grounding Electronic Equipment (IEEE Emerald Book.
IEC 603-7, Part 7	Detailed Specifications for Connectors, 8-Way, Including Fixed and Free Connectors with Common Mating Schemes.
ISO/IEC IS 11801A	Generic Cabling for Customer Premises.
NEMA WC 63	Performance Standard for Field Testing of Unshielded Twisted-Pair Cabling System.
OESC	Ontario Electrical Safety Code - 23rd Edition/2002.
OHSA	Occupational Health and Safety Act - R.S.O. 1990, c. 0-1.
O.R. 388/97	Ontario Fire Code.
O.R. 403/97	Ontario Building Code 1997.
UL 444 and 13	Adopted Test and Follow-Up Service Requirements For The Optional Qualification of 100Ω Twisted-Pair.
NCTA	National Cable Television Association.
NCTA-02/89 rev. 93	NCTA Recommended Practices for Measurements on Cable Television Systems.

.5 Comply with the Ontario Electrical Safety Code, all Local, Provincial and Federal laws, where applicable and with requirements of the Canadian Standards Association (CSA) when mandatory. Make any changes or alterations required by the authorised inspector of the authority having jurisdiction, at no extra charge to the Client.

2 PRODUCTS

2.1 NOT USED

3 EXECUTION

3.1 CODE, STANDARD AND REGULATION COMPLIANCES

.1 All cables and components shall be installed and terminated in accordance with CSA, ANSI/EIA/TIA-568B and its Amendments as well as UL/ULC Guidelines. Particular attention shall be given to maintaining the integrity of the pair twists, bend radius and ensuring proper distance is kept from fluorescent light fixtures, electrical cables or any other source of EMI. Cables shall be combed and bundled in a neat and organised manner. The Communications Consultant will determine neatness of the installation. Cables that have not been properly combed and dressed shall be re-dressed at the Cabling Contractor's expense. The Cabling Contractor shall co-ordinate with the Communications Consultant prior to termination in any Telecom Room.

.2 The maximum horizontal run length shall not exceed 90-metres. If the 90-metre constraint cannot be met, the Cabling Contractor shall notify the Communications Consultant of any cables that exceed 90-metres, prior to their installation.

END OF SECTION 27 00 05.30

1 GENERAL

1.1 WORK INCLUDED

.1 Conform to Section 27 00 05.10 – GENERAL INSTRUCTIONS FOR COMMUNICATIONS SECTIONS.

1.2 SUBMITTALS - DRAWING DOCUMENTATION AND CABLE TEST RESULTS

.1 The Cabling Contractor shall be provided with drawing(s) for construction on which the Cabling Contractor shall clearly mark all changes and deviations during the construction process, which shall include the pathway of the cables from the Telecom Room(s) to the Workstations or between Telecom Rooms. Drawing(s) shall be kept up-to-date during construction and in addition to field measurements shall include field instructions and all other changes. The as-built drawing(s) shall also include all additional cables installed during the project. The Communications Consultant shall have the right to inspect the status of the as-built drawing(s) from time to time during the construction process. On completion of the project, the Cabling Contractor shall forward to the Communications Contractor two sets of drawings indicating all such changes and deviations for review within 5 business days of the completion of the project.

.2 The Cabling Contractor shall supply (temporary hand-marked) as-built drawings to Communications Consultant for Client use 3 days prior to cut-over.

.3 The Cabling Contractor shall request (via email) from the Communications Consultant soft copy of drawings for use by the Cabling Contractor in preparation for record (as-built) drawings.

.4 All changes to drawing(s) shall be Engineering Draft Standards. All Voice, Data and Coaxial outlet locations shall be identified with proper designation.

.5 The Cabling Contractor shall return record drawing(s) on CD(s) using AutoCAD R2000 or better. If the Cabling Contractor cannot comply with this requirement, Smith and Andersen will update all hand drawn as-builts to AutoCAD. The cost for this service shall be based on per diem rates at time of completion. The Cabling Contractor shall be responsible for the costs associated with this work.

.6 The Cabling Contractor shall print / plot **two** sets of as-built drawings at no extra cost. Final as-built print(s)/plot(s) shall not contain markings or corrections by hand (i.e. marker, pen, pencil, etc.) and shall be delivered to Smith and Andersen for final review and delivery to the Client.

.7 The Cabling Contractor shall produce a test report based on the cable schedules. The report shall indicate for each cable, when it was tested successfully and the signature of the technician that performed the test. An authorized person for the Cabling Contractor must sign the entire report. The Cabling Contractor shall forward 1 hard copy in a white 3 D-ring binder to Smith and Andersen's office within 5 business days of the completion of the project. The hard copy shall be provided in a one page per cable/strand test format. The Cabling Contractor is also required to supply 1 soft copy on CD(s) in the tester's native format, along with the appropriate software to read the test results. These files shall be provided on a CD(s) separate from the record drawings CD(s).

.8 The project will remain incomplete and a holdback will be retained until satisfactory as-built drawing(s) and cable test results are provided.

1.3 SUBMITTALS - TESTING AND COMMISSIONING

.1 Provide testing and commissioning documentation for all items and their related components to the Communications Consultant prior to the completion of the project or at the Communications Consultants request. Include maintenance manuals and operating instructions for Client's staff use.

1.4 PERMITS, LICENSE INSPECTIONS AND FEES

.1 Where materials are specified which require special inspection and approval of CSA and/or local authorities obtain such approval for the particular installation with the co-operation of the material supplier. Obtain and pay for permits and inspection required for work performed.

.2 Submit required Documents and shop drawings to authorities having jurisdiction in order to obtain approval for the work. Copies of Contract Drawings and Specifications may be used for this purpose. Prepare any additional information, details and drawings that these authorities may require.

1.5 ALTERNATE PRODUCT

.1 This document specifies the use of a complete end to end Structured Cabling Solution as manufactured, warranted and certified by a single manufacturer. Alternate materials (from the overall cabling solution) will not be accepted unless specifically noted.

.2 Where supply of the materials would compromise the schedule, the Cabling Contractor shall be required to submit a request to use alternate product to the Communications Consultant. Depending on the circumstance, the Communications Consultant may provide written authorisation to substitute the Product. Written authorisation shall be obtained before alternatives are purchased or installed.

1.6 SCHEDULING

.1 Within one week of award of the contract submit a formal project schedule to the Communications Consultant showing start and finish dates of major tasks as denoted by System, backbone cabling, horizontal cabling, rack and cabinet installation, material order and delivery to site and testing.

.2 Updated schedules shall be submitted as periodically requested by Communications Consultant.

1.7 CLEANUP

.1 The Cabling Contractor is responsible for keeping the site and surrounding area clean, safe and free from debris at all times. All debris must be removed from the site on a daily basis. The costs for cleaning are the responsibility of the Cabling Contractor.

.2 Upon completion of the work and before acceptance and final payment will be made, the Cabling Contractor shall clean and remove from the site, all surplus and discarded materials, temporary structures and debris of every kind. Surplus and waste materials removed from the site shall be disposed of in accordance with applicable laws and regulations.

1.8 ACCEPTANCE

.1 Before acceptance by the Communications Consultant, all the equipment and cabling must be cleaned and tested. At points of termination, all cabling and terminations must be free of any cable pulling lubricants before acceptance by the Communications Consultant.

1.9 INSPECTION AND TESTING REQUIREMENTS

.1 The Communications Consultant must approve the testing procedure prior to testing commencing and may request to be present during the initial testing.

.2 The Communications Consultant shall be invited to witness field testing and shall be notified of the start date of the testing phase 5 business days before testing commences. Upon completion of the testing by the Cabling Contractor the Communications Consultant may ask the Cabling Contractor to perform a random test of up to 10% of the links. The Cabling Contractor shall test these randomly selected links and the results shall be stored

in accordance with this document. The results obtained shall be compared to the original test data. A penalty of $50.00 shall be deducted from the Contract amount for each cable that fails to pass the random test. If more than 2% of the sample results differ in terms of the pass/fail determination, the Cabling Contractor under supervision of the Communications Consultant shall repeat 100% testing. The cost of the labour required for the testing as well as the cost for the supervision by the part of Communications Consultant shall be borne by the Cabling Contractor.

1.10 SUBMITTALS - CONNECTIVITY DATABASE

.1 The Cabling Contractor shall prepare separate Data and Voice Connectivity Databases in Microsoft Excel spreadsheet format that includes the following:

.1 Data - For data connectivity, this shall include but shall not be limited to workstation ID or number, horizontal Data cable number, active equipment port and copper and/or fibre backbone cable/strand.

.2 Voice (Centrex) - For voice connectivity, this shall include but shall not be limited to workstation ID or number, horizontal Voice cable number, backbone pair, service provider demarcation pair(s), DID and LEN.

.3 Voice (PBX) - For voice connectivity, this shall include but shall not be limited to workstation ID or number, horizontal Voice cable number, backbone pair and Telephone Switch/Node TN.

.2 One hard copy and one soft copy shall be supplied to the Communications Consultant.

2 PRODUCTS

2.1 NOT USED

3 EXECUTION

3.1 NOT USED

END OF SECTION 27 00 05.60

1 GENERAL

1.1 WORK INCLUDED

.1 Conform to Section 27 00 05.10 – GENERAL INSTRUCTIONS FOR COMMUNICATIONS SECTIONS.

1.2 CABLE INSTALLATION

.1 The Cabling Contractor shall assume that the entire cable installation will be done during regular hours, except:

.1 as noted in Section 27 00 05.10 of this specification;

.2 as outlined in the project schedule.

1.3 FLOOR/CEILING TILES

.1 The Cabling Contractor shall be responsible for the removal and re-installation of all floor/ceiling tiles in areas affected by their work. This shall be done on a daily basis for all areas that are occupied during the construction period. Otherwise the Cabling Contractor shall remove and re-install the tiles after their work is complete.

.2 Any damage to ceiling tiles during the installation of any work described in this document shall be the responsibility of the Cabling Contractor. Damages include chipping, breaking or fingerprints. Final decisions on the trade responsible for any damage to ceiling tiles shall be made by the Project Manager and/or the Communications Consultant.

.3 The Cabling Contractor shall be responsible for storage and protection of floor/ceiling tiles when they have been removed from the floor/ceiling grid.

1.4 CUT OVER PLANNING AND MANAGEMENT

.1 The Cabling Contractor shall allow for 1 technician for 8 regular hours to be on site for cut over support for each phase. The technician shall be available to provide services to the Client as required. This may involve additional testing or Move, Add, Change activity. Any additional materials used shall be addressed separately.

.2 The Cabling Contractor shall schedule their installers such that the cut over schedule is maintained. Any shift work or overtime that is required to complete the project on schedule shall be included in the Cabling Contractor's Tender bid.

1.5 SAFETY OF PERSONS AND PROPERTY

.1 The Cabling Contractor shall comply with all laws, ordinances, rules, regulations, policies of the Client and lawful orders of any public authority having jurisdiction for safety of persons or property or to protect them from damage, injury or loss.

.2 Moderate public pedestrian traffic should be expected around all work locations. Ladders scaffold, installation materials, and all other hazardous conditions shall be fully protected at all times. Warning cones, signs, barricades and warning tapes shall be used to warn and protect persons and property at all times in public corridors.

.3 Work shall not interfere with legal fire exits. Corridors, areas of egress, fire protection stand pipes, hydrants and exit stairs shall be maintained at all times.

.4 No open flames/smoking shall be permitted without prior written approval of the Client.

.5 The Cabling Contractor is responsible setting up and removal of all signage and safety measures to ensure that other trades and non-trade personnel are safe from work of the Cabling Contractor.

1.6 ACCESS TO SITE

.1 The Cabling Contractor shall be responsible for coordinating site access with the General Contractor and/or Client as determined during the initial project meeting.

1.7 IDENTIFICATION

.1 All Cabling Contractor personnel shall be clearly identified by either uniform or company ID. In addition, the Cabling Contractor may be required to wear Client provided ID for required card access locations or identification. All Client ID must be returned daily or at the end of the project as determined by the Client.

1.8 EMERGENCY FACILITIES

.1 The Cabling Contractor shall maintain at all times free access to fire lanes and emergency and utility control facilities such as fire alarm boxes, utility vaults, manholes and junction boxes.

1.9 PRODUCT DELIVERY REQUIREMENTS

.1 The Cabling Contractor shall be responsible for complete delivery, handling, and installation of all materials used in the performance of the work.

.2 Arrange for the delivery of Client furnished equipment/materials related to this Specification and related items, including unloading of supplier's truck, elevator scheduling and placement on Client premises as indicated on Contract drawings.

1.10 PRODUCT AND TOOLS STORAGE REQUIREMENTS

.1 The Cabling Contractor shall be responsible for complete storage and handling of all materials used in the performance of the work.

.2 The Cabling Contractor shall be allowed to store job boxes on the site during construction. The tools and the job box shall be the responsibility of the Cabling Contractor. The Client and his representative shall be in no way responsible or liable for any tools of the Cabling Contractor.

1.11 CONFINED SPACES

.1 The Cabling Contractor shall comply with all code related and Client specific safety requirements, if work is to be performed in a confined space.

1.12 CO-ORDINATION WITH OCCUPANTS

.1 The Cabling Contractor shall be responsible for co-ordinating all work with the Client/tenant of the floor space for their daily work.

1.13 PROJECT MEETINGS

.1 The Cabling Contractor shall attend site meetings when requested by the Communications Consultant and/or the Project Manager. Regular meetings may occur once per week at the Communications Consultant's and/or the Project Manager's discretion.

.2 The Cabling Contractor shall attend weekly project meetings throughout the duration of the project to review the status of current and planned activities, schedule and conduct other business associated with the project.

.3 PROGRESS REPORTS

.4 The Cabling Contractor shall issue a status report at the weekly project meeting including status of: progress, project completion for phases, material ordering and delays.

2 PRODUCTS

2.1 NOT USED

3 EXECUTION

3.1 PRODUCT DELIVERY REQUIREMENTS

.1 The Cabling Contractor shall unload materials from delivery trucks in such a manner as to protect the materials from damage. In particular, reels of cable shall not be unloaded by dropping them off the vehicle.

3.2 PROTECTING INSTALLED SYSTEMS AND CONSTRUCTION

.1 The Cabling Contractor shall be responsible for the assembly of above equipment/materials and protection of the above equipment and related items until project cut over. Any damage to equipment shall be the liability of the Cabling Contractor. All damage shall be repaired or at the Client's request, the equipment shall be replaced at no extra charge to the Client.

END OF SECTION 27 00 05.70

1 GENERAL

1.1 WORK INCLUDED

.1 Conform to Section 27 00 05.10 – GENERAL INSTRUCTIONS FOR COMMUNICATIONS SECTIONS.

1.2 GENERAL

.1 Use only fire stopping products that have been tested for specific fire resistance rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements, and fire rating involved for each separate instance.

1.3 MANUFACTURERS

.1 Products manufactured by Specified Technologies Inc. (or approved equivalent) are acceptable.

.2 Obtain fire stop systems for each type of penetration and construction condition indicated only from a single manufacturer.

1.4 FIRE STOPPING

.1 Provide seals in all Fire Rated Separations and Firewalls to form tight barriers to retard the passage of flame and smoke.

.2 The installed seals shall provide and maintain the fire resistance rating of the adjacent floor, wall or other fire separation assembly to the Code Requirements.

.3 Moisture seals as well as fire and smoke seals shall be required for all floor penetrations in Laboratories and Operating Rooms in Hospitals, Universities and Schools.

.4 The Cabling Contractor shall establish/re-establish the integrity of all fire-rated structures and assemblies that they have created or disturbed, or were created by others for use by the Cabling Contractor.

.5 Supply and install Fire Stop pillows for existing cable tray penetrations through firewalls.

.6 For the purposes of this specification, the only acceptable Fire Stop Systems shall be those that have been tested to the CAN/ULC S115 Standard.

.7 Supply and install non-permanent CSA approved Fire Stop systems that are dielectric, water resistant, non-hardening, permanently pliable/re-enterable putty along with the appropriate damming or backer materials (where required).

.8 All fire stopping shall maintain a minimum one hour rating and shall meet applicable Federal, Provincial and Local building codes.

.9 All Fire Stop Systems shall be listed and tested by an SCC and accredited Third Party Testing Agency in accordance with the Standards.

.10 Fire resistance ratings of installed Fire Stop Systems shall not be less than the fire resistance rating of the surrounding Fire Separation or Firewall.

.11 All Smoke Seals selected for use shall comply with Standards.

.12 Where moisture seals are required for floor penetrations in Operating Rooms, Morgues, and Laboratories in Hospitals, Universities and Schools, the Fire Stop Materials selected shall be compatible with Formalin.

.13 All Fire Stop Materials and Smoke Seals shall have elastomeric characteristics to allow for building settling and seismic movement. All Fire Stop Materials and Smoke Seals shall be free of asbestos.

1.5 WATER PROOFING

.1 The Cabling Contractor shall seal all foundation penetrating conduits and service entrance conduits and sleeves to eliminate the intrusion of moisture and gases into the building. This requirement also includes spare conduits.

.2 All service entrance conduits through building shall be sealed or resealed upon cable placement. Spare conduits shall be plugged with expandable plugs.

1.6 QUALITY ASSURANCE

.1 Provide fire stopping systems that comply with the following requirements:

.1 Fire stopping tests are performed by a qualified, testing and inspection agency. A qualified testing and inspection agency is UL, or another agency performing testing and follow-up inspection services for fire stop system acceptable to authorities having jurisdiction.

.2 Fire stopping products bear the classification marking of qualified testing and inspection agency.

.2 Provide the work of this Section using competent installers, experienced in the application of the materials and systems being used, approved and trained by the material or system manufacturer.

.3 Fire Stop Systems shall conform to the fire (F), hose (H) and temperature (T) ratings of Codes.

.4 Fire Stop Materials and Smoke Seal materials shall have a flame spread rating of 25 or less, National Fire Protection Association (NFPA Class "A").

.5 For the purposes of this specification the only acceptable Fire Stop Systems are those that have been tested to the CAN/ULC S115 Standard.

1.7 PERFORMANCE

.1 Fire rated pathway devices shall be the preferred product and shall be installed in all locations where frequent cable moves, add-ons and changes will occur.

.2 Where non- mechanical products are utilized, provide products that upon curing do no re-emulsify, dissolve, leach, breakdown or otherwise deteriorate over time from exposure to atmospheric moisture, sweating pipes, ponding water or other forms of moisture characteristic during or after construction.

.3 Where it is not practical to use a mechanical device, openings within floors and walls designed to accommodate telecommunications and data cabling shall be provided with re-enterable products that do not cure or dry.

.4 Openings for cable trays shall be sealed using re-enterable fire stopping pillows.

1.8 PROJECT CONDITIONS

.1 Do not install fire stopping products when ambient or substrate temperatures are outside limitations recommended by manufacturer.

.2 Do not install fire stopping products when substrates are wet due to rain, frost, condensation, or other causes.

.3 Maintain minimum temperature before, during, and for a minimum 3 days after installation of materials.

.4 Do not use materials that contain flammable solvents.

.5 Coordinate construction of openings and penetrating items to ensure that through-penetration fire stop systems are installed according to specified requirements.

.6 Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate through-penetration fire stop systems.

.7 Schedule installation of fire stopping after completion of penetrating item installation but prior to covering or concealing of openings.

2 PRODUCTS

2.1 FIRE STOP SEALANTS

.1 Firestop Sealants: STI SpecSeal® Brand single component latex formulations that upon cure do not re-emulsify during exposure to moisture. The following products are acceptable:

.1 Specified Technologies Inc. (STI) SpecSeal® Series SSS Sealant;

.2 Specified Technologies Inc. (STI) SpecSeal® Series LCI Sealant.

2.2 FIRE STOP PUTTY

.1 Firestop Putty: STI SpecSeal® Brand intumescent, non-hardening, water resistant putties containing no solvents, inorganic fibres or silicone compounds. The following products are acceptable:

.1 Specified Technologies Inc. (STI) SpecSeal® Series SSP Putty.

2.3 FIRE STOP PILLOWS

.1 Firestop Pillows: STI SpecSeal® Brand re-enterable, non-curing, mineral fibre core encapsulated on six sides with intumescent coating contained in a flame retardant poly bag. The following products are acceptable:

.1 Specified Technologies Inc. (STI) SpecSeal® Series SSB Pillows.

2.4 FIRE RATED CABLE PATHWAYS

.1 Fire Rated Cable Pathways: STI EZ-PATH™ Brand device modules comprised of steel raceway with intumescent foam pads allowing 0 to 100 percent cable fill. The following products are acceptable:

.1 Specified Technologies Inc. (STI) EZ-PATH™ Fire Rated Pathway.

3 EXECUTION

3.1 FIRE STOPPING

.1 Before beginning installation, verify that substrate conditions previously installed under other sections are acceptable for installation of fire stopping in accordance with manufacturer’s installation instructions and technical information.

.2 Examine sizes and conditions of voids to be filled to establish correct thickness and installation of Fire Stop Materials.

.3 Surfaces shall be free of dirt, grease, oil, scale, laitance, rust, release agents, water repellents, and any other substances that may inhibit optimum adhesion.

.4 Prepare surfaces in contact with Fire Stop Systems and Smoke Seals to manufacturer's instructions. Mask where necessary to avoid spillage and over coating onto adjoining surfaces; remove stains on adjacent surfaces.

.5 The Cabling Contractor shall be required to install/replace sound barrier/fire stopping materials as soon as cables have been pulled through the opening.

.6 In all Fire Stop Systems that require mineral wool or ceramic fibre backer or filler materials, these materials shall be dry and free of other contaminants before, during and

after installation of sealant Fire Stop Materials. Alkaline water contamination of the backer or filler materials may cause corrosion of metallic penetrating items.

.7 Apply Fire Stop Systems and Smoke Seals in strict accordance with manufacturer's instructions to prevent the passage of fire and smoke, and where required and / or specifically designated, the passage of fluids.

.8 Provide temporary forming and packing as required. Tool or trowel all exposed surfaces to smooth, neat and tidy finish.

.9 Fire Stop and smoke seal gaps and holes in all Fire Separation and Firewall construction through which cables pass as a result of work in this document.

.10 In Combustible Construction (membrane GWB type) where the framing members are wood or where paper faced insulation is incorporated within the separation, a Fire and Temperature rise "FT" rating is required equal to that of the rating of the Fire Separation. Include openings which have been formed and sleeved.

3.2 WATER PROOFING

.1 Conduits with cables in them shall be permanently sealed by firmly packing the void around the cable with oakum and capping with a hydraulic cement or water proof duct seal.

3.3 EXPOSED SERVICE PENETRATIONS IN CEILING OF UNDERGROUND PARKING AREAS

.1 Where the bottom of a Fire Stop System is exposed, seal bottom side of the assembly with a fire rated elastomeric Fire Stop sealant.

3.4 CLEAN UP

.1 Remove excess materials and debris and clean adjacent surfaces immediately after application to satisfaction of Project Manager. Remove and or correct staining and discolouring of adjacent surfaces as directed.

END OF SECTION 27 00 06.00

1 GENERAL

1.1 WORK INCLUDED

.1 Conform to Section 27 00 05.10 – GENERAL INSTRUCTIONS FOR COMMUNICATIONS SECTIONS.

.2 This document describes the products and execution requirements relating to supplying and installing Grounding and Bonding for Communications Systems.

.3 This section includes minimum requirements for the following:

.1 Grounding System;

.2 Telecommunications Grounding Busbar (TGB);

.3 Telecommunications Main Grounding Busbar (TMGB);

.4 Telecommunications Bonding Backbone (TBB);

.5 Rack Grounding and Bonding;

.6 Cabinet Grounding and Bonding.

.4 All cables and related terminations, support and grounding hardware shall be furnished, installed, wired, tested, labelled, and documented by the Communications Contractor as detailed in this document.

.5 Product specifications, general design considerations, and installation guidelines are provided in this document.

.6 The Communications Contractor shall meet or exceed all requirements for the grounding system described in this document.

1.2 GENERAL REQUIREMENTS

.1 Local electrical codes shall be adhered to.

.2 The grounding system shall comply with ANSI/TIA-942 and J-STD-607-A.

.3 The grounding system shall create a low impedance path to earth ground for electrical surges and transient voltages.

.4 The grounding system shall be intentional, visually verifiable, adequately sized to handle expected currents safely, and direct these potentially damaging currents away from sensitive network equipment. As such, the grounding shall be purposeful in its design and installation.

.5 All grounding conductors shall be copper.

.6 Lugs, HTAPs, grounding strips, and busbars shall be UL Listed and made of premium quality tin-plated electrolytic copper that provides low electrical resistance while inhibiting corrosion. Antioxidant shall be used when making bonding connections in the field.

.7 Wherever possible, two-hole lugs shall be used because they resist loosening when twisted (bumped) or exposed to vibration. All lugs shall be irreversible compression and meet NEBS Level 3 as tested by Telcordia. Lugs with inspection windows shall be used in all non-corrosive environments so that connections may be inspected for full conductor insertion (battery rooms are an exception where windowless lugs may be used).

.8 Die index numbers shall be embossed on all compression connections to allow crimp inspection.

.9 Cable assemblies shall be UL Listed and CSA Certified. Cables shall be a distinctive green or green/yellow in color, and all jackets shall be UL, VW-1 flame rated.

.10 Electrical continuity throughout each rack or cabinet is required to minimize safety risks. The Cabling Contractor shall supply and install all necessary hardware to ensure that each part of each rack and each cabinet is grounded.

.11 Any metallic component that is part of a Telecommunications Room, LAN Room, Entrance Facility, Computer Room, Data Centre (etc.), including equipment, racks, cabinets, ladder racks, enclosures, cable trays, duct work, etc. shall be bonded to the grounding system.

1.3 TELECOMMUNICATIONS BONDING BACKBONE REQUIREMENTS

.1 The Telecommunications Grounding Busbar (TGB) in each telecommunications space shall be grounded to the Building Ground Riser by Division 16/26. The TGB and its Telecommunications Bonding Backbone (TBB) shall be supplied and installed by Division 16/26.

.2 The gauge of the connecting ground cable, known as the Telecommunications Bonding Backbone (TBB) will follow J-STD-607-A guidelines, as is shown in the table below.

Sizing of the TBB (by Division 16/26)	
TBB Length in Linear metres (feet)	TBB Size (AWG)
Less than 4 (13)	6
4-6 (14-20)	4
6-8 (21-26)	3
8-10 (27-33)	2
10-13 (34-41)	1
13-16 (42-52)	1/0
16-20 (53-66)	2/0
Greater than 20 (66)	3/0

.3 In telecommunications spaces with only one rack or cabinet, the grounding jumper cable can be connected directly to the TGB

2 PRODUCTS

2.1 EQUIVALENT PRODUCTS

.1 All grounding and bonding products required to meet the requirements of this section and the applicable codes and standards shall be manufactured by Panduit.

.2 PANDUIT STRUCTUREDGROUND™ Grounding System kits, components, and hardware shall be used to construct the grounding system.

2.2 TELECOMMUNICATIONS GROUNDING BUSBAR

.1 The Telecommunications Grounding Busbar (TGB) shall be supplied and installed by Division 16/26. The Communications Contractor shall use Panduit LCC-W series lugs when connecting conductors to the TGB.

2.3 COMMON BONDING NETWORK

.1 The Cabling Contractor shall supply and install a #2 AWG Common Bonding Conductor within each Telecommunications Room, LAN Room, Entrance Facility, Computer Room, Data Centre (etc.) as shown on drawings. Where a Common Bonding Network is specified (refer to drawings), route the CBN to each TGB in as straight a path as possible. The CBN should be installed as a continuous conductor.

.2 Avoid routing grounding conductors in metal conduits. If the grounding conductor must be routed through a metal conduit, bond each end of the conduit to the grounding conductor. Use *PANDUIT* GPL series grounding clamps to bond to the conduit, a *PANDUIT* HTWC HTAP with clear cover to bond to the grounding conductor, and a #6 AWG copper conductor to connect the GPL grounding clamp to the HTWC HTAP.

2.4 RACK GROUNDING

.1 For every (two post) rack the Cabling Contractor shall supply and install all components as listed below to ensure electrical continuity of ground between all rack elements as well as installed equipment.

.1 For racks that are assembled with nuts and bolts, the Cabling Contractor shall supply and install Panduit paint piercing grounding washers, series RGW to provide electrical continuity between rack elements where rack sections bolt together, on both sides, under the head of the bolt and between the nut and rack (a total of 8 washers required per rack). Where a rack is supplied from factory assembled by way of welding all components, paint piercing grounding washers are not required.

.2 For racks using metal vertical cable managers, the Cabling Contractor shall supply and install Panduit paint piercing grounding washers, series RGW to provide electrical continuity between rack rails and vertical cable managers where they bolt together, on both sides, under the head of the bolt and between the nut and rack (2 washers are required for every set of bolt and nut).

.3 The Cabling Contractor shall supply and install one full-length rack ground strip per rack, Panduit series RGS, attached to the rear of the side rail with the thread-forming screws provided to ensure metal-to-metal contact.

.4 The Communications Contractor shall supply and install the appropriate Panduit RG series jumper for the equipment (such as network switches) being installed and the thread-forming screws provided in the kit. For quantity and part numbers refer to table below.

Panduit	Equipment Jumper Kit Description
RGEJ624PH	#6 AWG; 24” Length; 45° bent lug on ground strip side, straight lug on equip. side
RGEJ624PF	#6 AWG; 24” Length; 90° bent lug on ground strip side, straight lug on equip. side
RGEJ636PF	#6 AWG; 36” Length; 90° bent lug on ground strip side, straight lug on equip. side
RGEJ657PF	#6 AWG; 57” Length; 90° bent lug on ground strip side, no lug on equip. side

.5 The Communications Contractor shall supply and install one common bonding network jumper, Panduit part number RGREJ696, to attach the rack ground strip to the Common Bonding Network (CBN), or directly to the Telecommunications Grounding Busbar (TGB) in the Telecommunications Room. Do **not** bond racks serially. Where a CBN is specified, use the copper compression HTAP that comes with the kit to bond the conductor to the CBN. Where a CBN is not specified, use a Code Conductor Two Hole Long Barrel with Window Lug – LCC6-14JAWH-L (not supplied with this kit) to bond the common bonding network jumper to the TGB.

.6 The Communications Contractor shall supply and install four (4) bonding screws for every patch panel, every horizontal cable manager and every switch (assume 48 port switches, one port for every horizontal cable installed). Patch panels, horizontal cable managers and switches shall be bonded to racks using Panduit bonding screws. Supply and install bonding screws as required for the appropriate equipment mounting hole size.

Panduit	Bonding Screw Description
RGTBSG-C	#12-24 screw for racks having #12-24 equipment mounting holes
RGTBS1032G-C	#10-32 screw for racks having #10-32 equipment mounting holes
RGTBSM6G-C	M6 screw for racks having M6 equipment mounting holes
RGTBSM5G-C	M5 screw for racks having M5 equipment mounting holes

.7 The Cabling Contractor shall supply and install one electrostatic discharge (ESD) port kit, Panduit series RGESD, directly to the rack grounding strip on the back of the rack at approximately 48 inches from the floor. The Cabling Contractor shall supply and install a second RGESD directly to the vertical mounting rail of the

rack in the front at approximately the same height. Use the thread-forming screws provided to form a bond to the rack. Place the ESD protection identification stickers directly above the ESD ports. ESD port installed in the front of the rack may be installed on top of a patch panel or horizontal cable manager

2.5 RETROFIT RACK GROUNDING

.1 Where racks already have network equipment installed, the Cabling Contractor shall supply and install all components as listed below to ensure electrical continuity of ground between all rack elements as well as installed equipment, without removing any equipment or patch cords.

.1 For racks using metal vertical cable managers, the Cabling Contractor shall supply and install Panduit paint piercing grounding washers, series RGW to provide electrical continuity between rack rails and vertical cable managers where they bolt together, on both sides, under the head of the bolt and between the nut and rack (2 washers are required for every set of bolt and nut)

.2 The Cabling Contractor shall supply and install one rack grounding busbar per rack, Panduit part number RGRB19, attached to the rear of the rack straddling both side rails with the thread-forming screws provided to ensure metal-to-metal contact.

.3 The Communications Contractor shall supply and install the appropriate Panduit RG series jumper for the equipment (such as network switches) being installed and the thread-forming screws provided in the kit. For quantity and part numbers refer to table below.

Panduit	Equipment Jumper Kit Description
RGEJ624PH	#6 AWG; 24” Length; 45° bent lug on ground strip side, straight lug on equip. side
RGEJ624PF	#6 AWG; 24” Length; 90° bent lug on ground strip side, straight lug on equip. side
RGEJ636PF	#6 AWG; 36” Length; 90° bent lug on ground strip side, straight lug on equip. side
RGEJ657PF	#6 AWG; 57” Length; 90° bent lug on ground strip side, no lug on equip. side

.4 The Communications Contractor shall supply and install one common bonding network jumper, Panduit part number RGREJ696, to attach the rack ground busbar to the Common Bonding Network (CBN), or directly to the Telecommunications Grounding Busbar (TGB) in the Telecommunications Room. Do **not** bond racks serially. Where a CBN is specified, the Communications Contractor shall supply and install a copper compression HTAP, Panduit part number HTWC250-2-1, to bond the conductor to the CBN. Where a CBN is not specified, the Communications Contractor shall supply and install a Code Conductor Two Hole Long Barrel with Window Lug, Panduit part number LCC6-14JAWH-L, to bond the common bonding network jumper to the TGB.

.5 The Communications Contractor shall supply and install four (4) bonding screws for every patch panel, every horizontal cable manager, every shelf and every switch (assume 48 port switches, one port for every horizontal cable installed). Patch panels, horizontal cable managers and switches shall be bonded to racks using Panduit bonding screws. Supply and install bonding screws as required for the appropriate equipment mounting hole size.

Panduit	Bonding Screw Description
RGTBSG-C	#12-24 screw for racks having #12-24 equipment mounting holes
RGTBS1032G-C	#10-32 screw for racks having #10-32 equipment mounting holes
RGTBSM6G-C	M6 screw for racks having M6 equipment mounting holes
RGTBSM5G-C	M5 screw for racks having M5 equipment mounting holes

.6 The Cabling Contractor shall supply and install one electrostatic discharge (ESD) port kit, Panduit series RGESD, directly to the rack grounding strip on the back of

the rack at approximately 48 inches from the floor. The Cabling Contractor shall supply and install a second RGESD directly to the vertical mounting rail of the rack in the front at approximately the same height. Use the thread-forming screws provided to form a bond to the rack. Place the ESD protection identification stickers directly above the ESD ports. ESD port installed in the front of the rack may be installed on top of a patch panel or horizontal cable manager.

2.6 CABINET GROUNDING - #12-24 OR #10-32 EQUIPMENT HOLE RAILS

.1 For every cabinet the Cabling Contractor shall supply and install all components as listed below to ensure electrical continuity of ground between all rack elements as well as installed equipment.

.1 The Cabling Contractor shall supply and install one full-length rack ground strip per equipment mounting rail (4 ground strips per cabinet), Panduit series RGS, attached to each rail with the thread-forming screws provided to ensure metal-to-metal contact.

RU	Rail Fastener	Cabinet Depth	
44 or 45	#12-24 or M6	36”	
44 or 45			
44 or 45			
44 or 45			

2.7 TELECOMMUNICATIONS GROUNDING AND BONDING CONDUCTOR LABEL KIT

.1 The Communications Contractor shall supply and install one Telecommunications Grounding and Bonding Conductor Label Kit for every rack and cabinet as well as one for every Telecommunications Grounding Busbar. Panduit part number LTYK.

3 EXECUTION

3.1 PRODUCT DELIVERY REQUIREMENTS

.1 The Cabling Contractor shall unload materials from delivery trucks in such a manner as to protect the materials from damage. In particular, reels of cable shall not be unloaded by dropping them off the vehicle.

3.2 PROTECTING INSTALLED SYSTEMS AND CONSTRUCTION

.1 The Cabling Contractor shall be responsible for the assembly of above equipment/materials and protection of the above equipment and related items until project cut over. Any damage to equipment shall be the liability of the Cabling Contractor. All damage shall be repaired or at the Client’s request, the equipment shall be replaced at no extra charge to the Client.

END OF SECTION 27 05 26.00

1 GENERAL

1.1 WORK INCLUDED

.1 Conform to Section 27 00 05.10 – GENERAL INSTRUCTIONS FOR COMMUNICATIONS SECTIONS.

.2 Supply and install cabling as detailed in Contract Documents. The Cabling Contractor shall use pathways (by Division 16 – as shown on drawings) to distribute the cables throughout the facility. Where cables leave the pathways provided by Division 16, the Cabling Contractor shall supply and install cable slings and/or j-hooks to support cabling up to point of termination.

1.2 INDOOR CABLE DISTRIBUTION

.1 Utilise all indicated and available cable pathways such as conduits, Communications cable tray, ducts, surface raceways (by Division 16) and furniture system channels except where otherwise noted.

.2 Inside buildings minimise any possibilities of disruption by maintaining the following minimum clearances from electrical and heat sources when routing cables.

Item	Minimum Clearance
Motors	1.20 m (4’-0”)
Transformers	1.20 m (4’-0”)
Conduit and cables used for electrical distribution less than 1kVA	0.30 m (1’-0”)
Conduit and cables used for electrical distribution greater than 1kVA	1.00 m (3’-0”)
Fluorescent Luminaries	12 cm (0’-5”)
Pipes (gas, oil, water, etc.)	30 cm (1’-0”)
HVAC (equipment, ducts, etc.)	15 cm (0’-6”)

1.3 OUTDOOR CABLE DISTRIBUTION

.1 Supply and install backbone cabling as detailed on drawings. The Cabling Contractor shall use the aerial support structures, duct bank, conduits, riser sleeves and Communications cable tray (by Division 16) to distribute the cables throughout the campus. Otherwise, cables shall be direct buried as detailed on Drawings.

.2 Exercise caution when pulling cables to avoid damage to any existing cables and follow manufacturer’s maximum pull-force and minimum bend radii.

.3 The Cabling Contractor shall not perform any work within nor climb into the power space on an aerial pole.

.4 Outside buildings, minimise any possibilities of disruption by maintaining the following minimum clearances from electrical sources when routing cables.

Item	Minimum Clearance
Aerial Pole	3.00 m (9’-10”)
Grounded Metal/Non-metallic sheath power cable	1.02 m (3’-4”)
Open supply conductors 0 to 8.7 kVA	1.02 m (3’-4”)
Open supply conductors 8.7 to 50 kVA	1.02 m (3’-4”)*
Drip loops for luminaires or traffic signal brackets	0.30 m (1’-0”)
Grounded supply equipment (transformers etc…)	0.76 m (2’-6”)

Notes: *Mid-span of Aerial Cables shall be at least 75% of above values.
*Add 0.4 inches per kVA above 8.7 kVA.

2 PRODUCTS

2.1 NON-CONTINUOUS CABLE SUPPORT

.1 The Cabling Contractor shall supply and install cable support for the distribution of horizontal and backbone cables where conduit or ladder tray has not been provided. Cable supports shall be manufactured by Erico, or approved equal.

Description	Max # Cat.3/Cat.5e Cables	Max # Cat.6 Cables	Erico*
J-Hook	16	10	CAT12
J-Hook	50	32	CAT21
J-Hook	80	50	CAT32
J-Hook	300	185	CAT64
Adjustable Cable Support	425	256	CAT425
Vertical Backbone Support	(N/A)	(N/A)	CAT600

Notes: *Product Codes shown indicate only Series numbers and are not application specific.

.2 The size of J-hooks/support shall suit quantity of cables in runs used for distribution.

.3 Include any other miscellaneous hardware (angled hanger bracket, hammer/screw on clamps) required to support horizontal and backbone cabling.

.4 The Cabling Contractor shall supply and install CAT425 supports for main cabling runs, regardless of quantity of cabling installed.

2.2 VELCRO TIE-WRAPS

.1 The Cabling Contractor shall supply and install Velcro tie-wraps. Only Velcro tie-wraps shall be acceptable. Under no circumstance shall plastic tie-wraps be used.

Panduit
HLS/HLM-15R0 (Black)

.2 If plastic tie-wraps are used the Cabling Contractor shall be required to remove and replace all affected cables at their own expense.

2.3 SPIRAL WRAP

.1 Size Spiral Wrap according to quantity of cables being fed into the system furniture. Spiral Wrap colour shall match system furniture manufacturer's power feed. Panduit part number: T50F-CX.

2.4 INNERDUCT

.1 For plenum rated spaces, supply and install plenum rated Innerduct. Carlon part number: CF4X1C-500 (size to suit).

.2 For riser rated spaces, supply and install riser rated Innerduct. Carlon part number: DF4X1C-500R (size to suit).

.3 Where Innerduct is installed for use with multimode fibre, it shall be Orange. Where Innerduct is installed for use with single mode fibre, it shall be Yellow. All Innerduct shall be installed with pre-lubricated pull tape.

2.5 GROUNDING WIRE

.1 Supply and install #6 AWG green grounding wire for all metallic components that shall be grounded.

3 EXECUTION

3.1 CABLE DISTRIBUTION

.1 Exercise caution when pulling cables in pathways to avoid damage to any existing cables and follow manufacturer's maximum pull-force and minimum bend radii.

.2 All cables and components shall be installed and terminated in accordance with applicable Codes, Standards and Regulations.

3.2 CABLE SUPPORT

.1 Caddy hangers shall be installed at 4' intervals (maximum). Cables shall be run such that sag between supports does not exceed 4". Secure all cables to J-hooks/supports with Velcro tie-wraps. Cables shall be combed and dressed for all visible portions of the install. The above noted conditions will be strictly checked and the Cabling Contractor will be required to comb and redress any cables that are unsatisfactory at no additional cost.

.2 Attaching to T-bar support rods is not acceptable. Anchors for hangers must not be drilled into post tensioned beams under any circumstances. The Cabling Contractor shall not use Hilti Pneumatic hammers. All anchors must be drilled into slab.

.3 The Cabling Contractor must minimize the disturbance or removal of 'fire spray' insulation during installation of cable supports.

3.3 VELCRO TIE-WRAPS

.1 Velcro tie-wraps shall be used to neatly dress cables; they shall be placed at a maximum of 4' intervals for horizontal distribution (centre points between cable supports).

.2 Velcro tie-wraps shall also be used to dress horizontal cables into racks/cabinets. For each row of the patch panel. Maximum spacing of Velcro for horizontal cables into or along vertical cable managers shall be no more than 6", this includes cabling dropped from the ladder tray or ceiling above.

3.4 SPIRAL WRAP

.1 Install Spiral Wrap from system furniture feed points to system furniture entry point. Spiral Wrap shall be butted so that no cables are exposed.

3.5 INNERDUCT

.1 All Fibre Cables shall be installed in innerduct over their entire length inside the building to provide mechanical protection. The fibre cabling may be installed without innerduct under the following conditions:

.1 armoured Fibre cabling;

.2 where a dedicated fibre conduit is installed that is 1.5" in diameter or less.

.2 Minimise the number of separate innerducts installed by pulling multiple fibre cables through each innerduct.

.3 Innerduct shall be CMR (FT4) or CMP (FT6) rated, as is appropriate for ceiling space classification. Innerduct shall be sized to suit installation requirements.

3.6 CABLE DISTRIBUTION

.1 Ensure ANSI/EIA/TIA-568-B installation practices are followed for Indoor cable distribution and ANSI/EIA/TIA-758 installation practices are followed for Outdoor cable distribution.

.2 Station personnel at each access point (i.e. Handhole, manhole, etc.) to observe and lubricate the cables being pulled. Submit tension pull calculation for installation of cables to Communications Consultant.

.3 Do not exceed the copper/fibre cables maximum tensile rating during installation. Monitor tension of the cable during installation. Use a dynamometer to record installation tension. Use a tension limiting device to prevent the exceeding of maximum pulling tension specifications during installation. The tension limit shall be set at or below the manufacturer's limit. The cable shall be taken up at intermediate pulling points with an intermediate take-up device as approved by the Communications Consultant, to prevent over tension on the cable.

.4 Minimum bend radius shall be as per manufacturer's recommendations.

.5 Make cable pulls continuous and steady between pull points. Do not interrupt the pull unless necessitated by excessive tension on the cable.

.6 Protect exposed cable ends from moisture ingress.

.7 Cable passing through manholes to have sufficient slack for expansion/contraction and shall be mounted with clips to prevent sagging.

3.7 DUCT AND CONDUIT

.1 Clean out each section of duct or conduit by pulling a steel wire brush and mandrel of the correct size through the duct or conduit before pulling cables. Bush, ream and remove any sharp projections on all conduits prior to installation of communications cables. When cleaning ducts, if obstructions are encountered which cannot be removed, advise the Communications Consultant of the problems encountered.

.2 Pull cables in bottom ducts/conduits first, leaving top ducts/conduits for future use. Apply manufacturer's recommended lubricant to cables to reduce friction between the cable and the duct. Cable grip shall be attached to the sheath and its strength members so that no direct force is applied to the conductors/fibres. The cable grip shall have a ball bearing swivel to prevent the cable from twisting during pulling.

END OF SECTION 27 05 28.00

1 GENERAL

1.1 WORK INCLUDED

.1 Conform to Section 27 00 05.10 – GENERAL INSTRUCTIONS FOR COMMUNICATIONS SECTIONS.

.2 100% of the installed cabling links shall be tested and shall pass the requirements of the Standards as defined within this document. Any failing link shall be diagnosed and corrected. The corrective action shall be followed with a new test to prove that the corrected link meets the performance requirements. The final and passing result of the tests for all links shall be provided in the test results documentation.

.3 All deficiencies shall be corrected before the Communications Consultant will provide a certificate to release the Holdback on the project.

.4 The Cabling Contractor is required to submit test results as specified under Section 27 00 05.60 – ADMINISTRATIVE REQUIREMENTS.

.5 Test patch cords to portable tester shall be designed for testing by the manufacturer. Field assembled patch cords shall not be acceptable. Field testers shall use the appropriate jack/tester adapter specified for use with the cabling jack(s) specified within this document.

.6 The Cabling Contractor shall produce a test report based on the cable schedules. The report shall indicate for each cable, when it was tested successfully, location, cable type, cable number and tester make and model. A sample of the test report shall be submitted to the Communications Consultant for approval. The entire report shall be signed by an authorised person for the Cabling Contractor at the end of the project.

1.2 COPPER CABLING TEST REQUIREMENTS

.1 Every cabling link in the installation shall be tested (as required by the Cabling specified) in accordance with the Telecommunications Industry Association (TIA) Standard ANSI/TIA/EIA-568-B.1.

.2 The installed twisted-pair horizontal links shall be tested from the Telecom Room to the workstation against the “Permanent Link” performance limits Specification as defined in ANSI/TIA/EIA-568-B.1.

.3 Trained technicians who have successfully attended an appropriate training program and have obtained a certificate, as proof thereof shall execute the tests. Appropriate training programs include installation certification programs provided by BICSI or the ACP (Association of Cabling Professionals) and Vendor supplied certifications for their product.

.4 The test equipment shall comply with or exceed the accuracy requirements for enhanced level II and/or level III field testers (according to Cabling specified) as defined in TIA-568-B; Annex I: Section I.4. The tester including the appropriate interface adapter shall meet the specified accuracy requirements. The accuracy requirements for the permanent link test configuration (baseline accuracy plus adapter contribution) are specified in Table I.4 of Annex I of TIA/EIA-568-B.2.

.5 The tester interface adapters shall be of high quality and the cable shall not show any twisting or kinking resulting from coiling and storing of the tester interface adapters. In order to deliver optimum accuracy preference is given to a permanent link interface adapter for the tester that can be calibrated to extend the reference plane of the Return Loss measurement to the permanent link interface. The Cabling Contractor shall provide proof that the interface has been calibrated within the period recommended by the Vendor. To ensure that normal handling on the job does not cause measurable Return Loss change, the adapter cord cable shall not be of twisted-pair construction.

.6 The Pass or Fail condition for the link-under-test is determined by the results of the required individual tests. Any Fail or Fail* result yields a Fail for the link-under-test. In order to achieve an overall Pass condition, the results for each individual test parameter must Pass or Pass*.

.7 A Pass or Fail result for each parameter is determined by comparing the measured values with the specified test limits for that parameter. The test result of a parameter shall be marked with an asterisk (*) when the result is closer to the test limit than the accuracy of the field tester. The field tester manufacturer must provide documentation as an aid to interpret results marked with asterisks. (Reference TIA-568-B; Annex I: Section I.2.2).

1.3 COPPER CABLING PERFORMANCE TEST PARAMETERS

.1 The test parameters for Cat 5e are defined in ANSI/TIA/EIA Standard 568-B.1; Section 11.2.4 as well as in Annex I; Section I.2.1 “Parameters to be reported”. The test of each Cat 5e link shall contain all of the following parameters as detailed below. In order to pass the link test all measurements (at each frequency in the range from 1 MHz through 100 MHz) shall meet or exceed the limit value determined in the above-mentioned Cat 5e Standard. In addition, the test parameters for Cat 6 are defined in TIA Cat 6 Standard, which refers to TIA/EIA-568-B.2. The test of each link shall contain all of the following parameters as detailed below. In order to pass the test all measurements (at each frequency in the range from 1 MHz through 250 MHz) shall meet or exceed the limit value determined in the above-mentioned Standard.

.2 Testing of all 4 pairs of the horizontal cable (as specified in this document) shall include but not be limited to the following:

.1 Wire Map including; end to end continuity, open and shorts, pair polarity;

.2 Cable length;

.3 Attenuation;

.4 NEXT/FEXT;

.5 ACR

.6 Return Loss;

.7 ELFEXT, PSELFEXT;

.8 Propagation Delay, Delay skew;

.9 PSNEXT, PSACR.

.3 The nominal velocity of propagation (NVP) must be set specific to each cable manufacturer before testing. The portable tester shall be within the calibration period recommended by the vendor in order to achieve the vendor-specified measurement accuracy.

1.4 OPTICAL FIBRE CABLING TEST REQUIREMENTS

.1 Every optical fibre cabling link in the installation shall be tested in accordance with the field test Specifications defined by the Telecommunications Industry Association (TIA) Standard ANSI/TIA/EIA- 568-B (or by the appropriate network application Standard(s) whichever is more stringent).

.2 ANSI/TIA/EIA-568-B, defines the passive cabling network, to include cable, connectors, and splices (if present), between two optical fibre patch panels (connecting hardware). A typical horizontal link segment is from the telecommunications outlet/connector to the horizontal cross-connect. This TIA document describes three typical backbone link segments: (1) main cross-connect to intermediate cross-connect, (2) main cross-connect to horizontal cross-connect, or (3) intermediate cross-connect to horizontal cross-

connect. The test shall include the representative connector performance at the connecting hardware associated with the mating of patch cords. The test does not, however, include the performance of the connector at the interface with the test equipment.

.3 Trained technicians who have successfully attended an appropriate training program and have obtained a certificate, as proof thereof shall execute the tests. These certificates may have been issued by any of the following organisations or an equivalent organisation:

.1 the manufacturer of the optical fibre cable and/or the optical fibre connectors;

.2 the manufacturer of the test equipment used for the field certification;

.3 training organisations authorised by BICSI (Building Industry Consulting Services International) or by the ACP (Association of Cabling Professionals™);

.4 Vendor supplied certifications for their product.

.4 Field test instruments for multimode fibre cabling shall meet the requirements of ANSI/TIA/EIA-526-14A. The light source shall meet the launch requirements of ANSI/EIA/TIA-455-50B; Method A. This launch condition can be achieved either within the field test equipment or by use of an external mandrel wrap (as described in clause 11 of ANSI/TIA/EIA-568-B.1) with a Category 1 light source. Field test instruments for singlemode fibre cabling shall meet the requirements of ANSI/EIA/TIA-526-7.

.5 The optical fibre launch cables and adapters must be of high quality and the cables shall not show excessive wear resulting from repetitive coiling and storing of the tester interface adapters.

.6 The Pass or Fail condition for the link-under-test is determined by the results of the required individual tests as detailed below.

.7 A Pass or Fail result for each parameter is determined by comparing the measured values with the specified test limits for that parameter.

1.5 OPTICAL FIBRE CABLING PERFORMANCE TEST PARAMETERS

.1 ANSI/TIA/EIA Standard 568-B prescribes that the single performance parameter for field testing of optical fibre links is link attenuation when installing components compliant with this Standard.

.2 The link attenuation shall be calculated by the following formulas specified in ANSI/TIA/EIA 568-B:

Link Attenuation — Cable_Attn + Connector_Attn + Splice_Attn

Cable Attn (dB) — Attenuation_Coefficient (dB/km) x Length (Km)

Connector Attn (dB) — Number_of_connector_pairs x connector_loss (dB)
(Maximum allowable connector_loss = 0.75 dB)

Splice_Attn (dB) — Number of splices (S) x splice_loss (dB)
(Maximum allowable splice_loss = 0.3 dB)

.3 The values for the Attenuation_Coefficient are listed in the table below:

Type of optical fibre	Wavelength (nm)	Attenuation Coefficient (dB/km)
Mulimode 62.5/125µm	850	3.5
	1300	1.5
Multimode 50/125 µm	850	3.5
	1300	1.5
Singlemode (Inside Plant)	1310	1.0

	1550	1.0
Singlemode (Outside Plant)	1310	0.5
	1550	0.5

.4 Link attenuation does not include any active devices or passive devices other than cable, connectors, and splices, i.e. link attenuation does not include such devices as optical bypass switches, couplers, repeaters, or optical amplifiers.

.5 The above link test limits attenuation are based on the use of the One Reference Jumper Method specified by ANSI/TIA/EIA-526-14A, Method B and ANSI/TIA/EIA-526-7, Method A.1. The user shall follow the procedures established by these Standards or application notes to accurately conduct performance testing.

.6 The Horizontal Link (multimode): acceptable link attenuation for a multimode horizontal optical fibre cabling Solution is based on the maximum 90 m (295 ft) distance. The horizontal optical fibre cabling link segments need to be tested at only one (1) wavelength. Because of the short length of cabling [90 m (295 ft) or less], attenuation deltas due to wavelength are insignificant. The horizontal link should be tested at 850 nm or 1300 nm in one direction in accordance with ANSI/EIA/TIA-526-14A, Method B, and One Reference Jumper. The horizontal link may be tested using a fixed upper limit for attenuation of 2.0 dB. This value is based on the loss of two (2) connector pairs, one (1) pair at the telecommunications outlet/connector and one (1) pair at the horizontal cross-connect, plus 90 m (295 ft) of optical fibre cable.

.7 The Backbone Link (multimode) shall be tested in one direction at both operating wavelengths to account for attenuation deltas associated with wavelength.

.8 Multimode Backbone Links shall be tested at 850 nm and 1300 nm in accordance with ANSI/EIA/TIA-526-14A. Because backbone length and the potential number of splices vary depending upon site conditions, the link attenuation equation shall be used to determine limit (acceptance) values.

.9 Singlemode Backbone Links shall be tested at 1310 nm and 1550 nm in accordance with ANSI/TIA/EIA-526-7, Method A.1, and One Reference Jumper. All singlemode links shall be certified with test tools using laser light sources at 1310 nm and 1550 nm (See Note below).

Notes:

.1 Link attenuation has been based upon the use of a light source categorised by a Coupled Power Ratio (CPR) of Category 2, Underfilled, per Annex B of ANSI/EIA/TIA-526-14A. The use of a light source categorised as Category 1, Overfilled, may provide results higher than the 2.0 dB limit. A field test tool based on LED (light emitting diode) light sources is a Category 1 device and typically yields high attenuation results.

.2 Links destined to be used with network applications that use laser light sources (underfilled launch conditions) shall be tested with test equipment based on laser light sources. This rule should be followed for Cabling Solutions to support Gigabit Ethernet. Gigabit Ethernet only specifies laser light sources.

.3 For Gigabit Ethernet compliant certification (IEEE STD 802.3z application), use test equipment which uses a VCSEL (Vertical cavity surface emitting laser) at 850 nm (compliant with 1000BASE-SX) and a FP laser at 1310 nm (compliant with 1000BASE-LX).

.10 Each optical fibre link terminated with an optical adapter system which does not impose a transmission direction because the adapters are not or cannot be ganged should be tested and documented in both directions since the direction of the signal transmission cannot be predicted at the time of installation.

.11 Test each strand of fibre with an Optical Time Domain Reflectometer for length and attenuation. Performance test must be below the total return loss budget for the cable connectors/balun. Provide comprehensive optical time domain reflectometry (OTDR) testing for all fibre runs. Include a hard copy chart recording with the test documentation.

1.6 WARRANTY AND CERTIFICATION REQUIREMENTS

.1 The Cabling Contractor is required to provide a **minimum of 20-year parts and labour Warranty** for the entire Structured Cabling Solution, including both UTP copper and fibre.

.2 Response time for Warranty items shall be 24 hours. The Cabling Contractor may be required to repair deficient Cabling Solution components outside regular working hours. Bidders shall include a statement of Warranty terms and conditions with their Bid Response.

.3 From the date of issuance of a "Certificate of Substantial Performance", all equipment, materials and workmanship must be unconditionally Warranted for a period of one (1) year, or such longer periods as may be provided in the Warranty of the manufacturer of individual components, whichever is longer.

.4 Provide a manufacturer Plaque and Warranty that the Structured Cabling Solution is installed and fully operating in accordance with this and the manufacturer specifications. A frame certificate will be acceptable if a plaque is not available from the manufacturer.

.5 Upon request and at no additional cost to the Client the Cabling Contractor must provide a manufacturer's technical representative to conduct an on-site visit to ensure complete technical compliance.

.6 All documentation including Plaque must be in English. The wording for the Plaque shall be submitted to the Communications Consultant for signed acceptance prior to their production.

2 PRODUCTS

2.1 ACCEPTABLE COPPER TESTERS

.1 Acceptable portable UTP test manufacturers include: HP/Agilent, Wirescope 350, Microtest, OMNIScanner and Fluke DSP-4000.

.2 ACCEPTABLE FIBRE TESTERS

.3 Acceptable portable fibre test manufacturers include: EXFO, Fotec, Laser Precision and Agilent 6000C.

.4 Provide 850nm and 1300nm ± 20nm wavelength LED light sources.

.5 Spectral width of sources shall be ± 50nm for 850nm wavelengths and ± 140nm for 1300nm wavelengths.

.6 Provide 1300nm and 1500nm ± 20nm wavelength Laser light sources.

.7 Output stability ± 0.40 dB from 0 to 50°C. Long term stability shall be ± 0.10 dB at 25°C

3 EXECUTION

3.1 WARRANTY AND CERTIFICATION REQUIREMENTS

.1 The Cabling Contractor shall forward the Structured Cabling Solution certification request form(s) to the proper authority and ensure that a Plaque is issued to the Client along with the Structured Cabling Solution user manual. The Cabling Contractor will provide a certification number within two weeks of award of this project.

.2 The Cabling Contractor will provide letter(s) of Certification within two weeks of substantial completion of the project to the Communications Consultant. This document will include the following: verification of the performance of the installed system,

identification of the installation by location and project number and a copy of the Warranty.

.3 Upon award of contract, the Cabling Contractor shall forward copies of the Structured Cabling Solution certification request for Certification form complete with certification number(s) for the project to Smith and Andersen's office within 7 days of the award of contract. Provide a copy of the form with Specification submission.

END OF SECTION 27 08 00.00

1 GENERAL

1.1 WORK INCLUDED

.1 Conform to Section 27 00 05.10 – GENERAL INSTRUCTIONS FOR COMMUNICATIONS SECTIONS.

.2 Supply and install cabling as detailed in Contract Documents. The Cabling Contractor shall use pathways (by Division 16) to distribute the cables throughout the facility. Where the cables leave the pathways and extend to the termination point they shall use J-hooks/cable support specified in this document.

.3 Avoid scraping, denting, or otherwise damaging cables, before, during or after installation. The Cabling Contractor without any additional compensation shall replace damaged cables.

.4 Ensure that all cable lengths are sufficient to allow for slack, vertical runs, wastage, connectorization and future moves.

1.2 CABLE ROUTING

.1 Make any necessary changes or additions to routing of cables, pathways to accommodate structural, mechanical, electrical and architectural conditions. Where pathways or cables are shown diagrammatically run them parallel to building columns. If it is necessary to run cables otherwise to accommodate acceptable cable lengths, written permission must be obtained from the Communications Consultant prior to installation.

.2 Any deviation from the cable routing, outlet and equipment locations shown on drawings must be approved by the Communications Consultant and documented on as-built drawings.

2 PRODUCTS

2.1 VOICE HORIZONTAL UTP COPPER CABLE

.1 All horizontal Voice cabling shall be Unshielded Twisted Pair (UTP), 4 pair, 22-26 AWG, with cable Category and Rating as indicated below. The cable must be CSA certified and stamped accordingly. All UTP Voice cables shall have an outer jacket colour as identified below.

Cat	Rating	Colour	Siemon*	Amp*	Belden*	Panduit*	Systimax*
6	CMP/FT6	White	9C6P4-E3-02-RXA	219567	2413	TX-6000	2071E XL

3 EXECUTION

3.1 GENERAL CONDITIONS

.1 When terminating copper cables remove only enough cable jacket to perform termination, untwist pairs a maximum of 13 mm (1/2”) for Category 5/5e/6 cables and 25 mm (1”) for Category 3 cables.

3.2 HORIZONTAL CABLE DISTRIBUTION

.1 Provide a minimum of 3.05 m (10’-0”) of slack at both ends of each cable to permit future cable relocation. Neatly coil slack in ladder tray. If ladder tray is not available ceiling space and cable supports may also be used to coil slack.

.2 Neatly bundle and tie-wrap all cables using Velcro tie-wraps. Separate Voice, Data and fibre cables into separate distinct bundles for identification purposes.

.3 Follow proper installation and termination practices for Category 3, 5, 5e, 6 and Optical Fibre cables. Do not kink or exceed the cable minimum bend radius or maintain a minimum of four (4) times cable diameter as bend radii if the manufacturer specifies no

bend radius. For Optical Fibre cables maintain a minimum of ten (10) times the cable diameter or 30 mm (1.2") whichever is larger for a bend radius.

.4 When bundling Category 3, 5, 5e, 6 and Optical Fibre cables, comply with manufacturer's recommended bundling practices for installation. Ensure that excess pressure is not placed on the cable at any point that may result in the compression or deformation of the cable jacket and internal pair/conductor geometry.

END OF SECTION 27 15 00.16

1 GENERAL

1.1 WORK INCLUDED

.1 Conform to Section 27 00 05.10 – GENERAL INSTRUCTIONS FOR COMMUNICATIONS SECTIONS.

.2 Supply and install cabling as detailed in Contract Documents. The Cabling Contractor shall use pathways (by Division 16) to distribute the cables throughout the facility. Where the cables leave the pathways and extend to the termination point they shall use J-hooks/cable support specified in this document.

.3 Avoid scraping, denting, or otherwise damaging cables, before, during or after installation. The Cabling Contractor without any additional compensation shall replace damaged cables.

.4 Ensure that all cable lengths are sufficient to allow for slack, vertical runs, wastage, connectorization and future moves.

1.2 CABLE ROUTING

.1 Make any necessary changes or additions to routing of cables, pathways to accommodate structural, mechanical, electrical and architectural conditions. Where pathways or cables are shown diagrammatically run them parallel to building columns. If it is necessary to run cables otherwise to accommodate acceptable cable lengths, written permission must be obtained from the Communications Consultant prior to installation.

.2 Any deviation from the cable routing, outlet and equipment locations shown on drawings must be approved by the Communications Consultant and documented on as-built drawings.

2 PRODUCTS

2.1 DATA HORIZONTAL UTP COPPER CABLE

.1 All horizontal Data cabling shall be Unshielded Twisted Pair (UTP), 4 pair, 22-26 AWG, with cable Category and Rating as indicated below. The cable must be CSA certified and stamped accordingly. All UTP Data cables shall have an outer jacket colour as identified below.

Cat	Rating	Colour	Siemon*	Amp*	Belden*	Panduit*	Systimax*
6	CMP/FT6	YELLOW					

3 EXECUTION

3.1 GENERAL CONDITIONS

.1 When terminating copper cables remove only enough cable jacket to perform termination, untwist pairs a maximum of 13 mm (1/2”) for Category 5/5e/6 cables and 25 mm (1”) for Category 3 cables.

3.2 HORIZONTAL CABLE DISTRIBUTION

.1 Provide a minimum of 3.05 m (10’-0”) of slack at both ends of each cable to permit future cable relocation. Neatly coil slack in ladder tray. If ladder tray is not available ceiling space and cable supports may also be used to coil slack.

.2 Neatly bundle and tie-wrap all cables using Velcro tie-wraps. Separate Voice, Data and fibre cables into separate distinct bundles for identification purposes.

.3 Follow proper installation and termination practices for Category 3, 5, 5e, 6 and Optical Fibre cables. Do not kink or exceed the cable minimum bend radius or maintain a minimum of four (4) times cable diameter as bend radii if the manufacturer specifies no

bend radius. For Optical Fibre cables maintain a minimum of ten (10) times the cable diameter or 30 mm (1.2") whichever is larger for a bend radius.

.4 When bundling Category 3, 5, 5e, 6 and Optical Fibre cables, comply with manufacturer's recommended bundling practices for installation. Ensure that excess pressure is not placed on the cable at any point that may result in the compression or deformation of the cable jacket and internal pair/conductor geometry.

END OF SECTION 27 15 00.19

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SCHEDULE OF FINISHING HARDWARE

FOR

CEDARVALE COMMUNITY SCHOOL

145 AVA RD
YORK, ONTARIO

Date: 15-Aug-11

Revised: 16-Sep-11

1 SGL DOOR D101-1 GYMNASIUM LHR
914 x 2134 x 45mm
WOOD DOOR / HOLLOW METAL FRAME
3/4 HR Fire Label

3 EACH	HINGES	STANLEY CB168 4 1/2 X 4 C26D
1 EACH	EXIT DEVICE	12-8888F C32D
1 EACH	EXIT DEVICE TRIM	713-8 ETB C26D
1 EACH	MORTISE CYLINDER	BASE BUILDING KEYWAY
1 EACH	KEYING	KEYING BY OTHERS
1 EACH	DOOR CLOSER	1431 UO EN - SURFACE MOUNTED
1 EACH	KICKPLATE	8in X 34.5in C32D TAPE
1 EACH	FLOOR STOP	GSH 209 C26D
1 SET	WEATHERSTRIP	W15 2/84in X 1/36in
17 FEET	DOOR GASKET	S88 BLACK

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1 SGL DOOR D101-2 GYMNASIUM RHR
914 x 2134 x 45mm
WOOD DOOR / HOLLOW METAL FRAME
3/4 HR Fire Label

3 EACH	HINGES	STANLEY CB168 4 1/2 X 4 C26D
1 EACH	EXIT DEVICE	12-8888F C32D
1 EACH	EXIT DEVICE TRIM	713-8 ETB C26D
1 EACH	MORTISE CYLINDER	BASE BUILDING KEYWAY
1 EACH	KEYING	KEYING BY OTHERS
1 EACH	DOOR CLOSER	1431 UO EN - SURFACE MOUNTED
1 EACH	KICKPLATE	8in X 34.5in C32D TAPE
1 EACH	FLOOR STOP	GSH 209 C26D
1 SET	WEATHERSTRIP	W15 2/84in X 1/36in
17 FEET	DOOR GASKET	S88 BLACK

---

1 PAIR OF DOORS D101-3 GYMNASIUM
2/935 x 2134 x 52
ALUMINUM DOOR / ALUMINUM FRAME
NOTE:
WEATHERSTRIP BY ALUMINUM DOOR SUPPLIER

6 EACH	HINGES	BY FRAME SUPPLIER
1 EACH	EXIT DEVICE	8410F C32D RHR EXIT ONLY NO TRIM
1 EACH	EXIT DEVICE	8410F C32D LHR EXIT ONLY NO TRIM
2 EACH	DOOR CLOSER	351 PS EN
1 EACH	THRESHOLD	CT10 X 72in AL
2 EACH	DOOR SWEEP	W24S X 36in AL

---

1 SGL DOOR D101-4 EXIT DOOR TBD
915mm x 2134 x 52
ALUMINUM DOOR / ALUMINUM FRAME
NOTE:
WEATHERSTRIP BY ALUMINUM DOOR SUPPLIER.

3 EACH	HINGES	BY FRAME SUPPLIER
1 EACH	EXIT DEVICE	8510 F C32D
1 EACH	DOOR CLOSER	351 PS EN
1 EACH	DROP PLATE	351-D EN
1 EACH	THRESHOLD	CT10 X 36in AL
1 EACH	DOOR SWEEP	W24S X 36in AL

NOTE:
CONFIRM HANDING DOOR NOT ON ORIGINAL DOOR SCHEDULE

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1 SGL DOOR D102A GIRLS CHANGE ROOM LH
914 x 2134 x 45mm
WOOD DOOR / HOLLOW METAL FRAME

3 EACH	HINGES	STANLEY CB168 4 1/2 X 4 C26D
1 EACH	MORTISE CLASSROOM LOCKSET	8237 LNB C26D
1 EACH	MORTISE CYLINDER	BASE BUILDING KEYWAY
1 EACH	KEYING	KEYING BY OTHERS
1 EACH	DOOR CLOSER	1431 UO EN - SURFACE MOUNTED
1 EACH	KICKPLATE	8in X 34.5in C32D TAPE
1 EACH	FLOOR STOP	GSH 209 C26D
17 FEET	DOOR GASKET	S88 BLACK

---

1 SGL DOOR D102B — BOYS CHANGE ROOM — RH
914 x 2134 x 45mm
WOOD DOOR / HOLLOW METAL FRAME

3 EACH	HINGES	STANLEY CB168 4 1/2 X 4 C26D
1 EACH	MORTISE CLASSROOM LOCKSET	8237 LNB C26D
1 EACH	MORTISE CYLINDER	BASE BUILDING KEYWAY
1 EACH	KEYING	KEYING BY OTHERS
1 EACH	DOOR CLOSER	1431 UO EN - SURFACE MOUNTED
1 EACH	KICKPLATE	8in X 34.5in C32D TAPE
1 EACH	FLOOR STOP	GSH 209 C26D
17 FEET	DOOR GASKET	S88 BLACK

EXISTING DOOR D103-1 — STORAGE — RHR
EXISTING DOOR / EXISTING FRAME
NOTE:
EXISTING DOOR, FRAME AND HARDWARE TO REMAIN

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1 PAIR OF DOORS D103-2 — STORAGE — RH ACTIVE
2/755 x 2134 x 45mm
HOLLOW METAL DOOR / HOLLOW METAL FRAME
3/4 HR Fire Label

6 EACH	HINGES	STANLEY CB168 4 1/2 X 4 C26D
2 EACH	FLUSH BOLT	F780 12in FIRE LABELED
1 EACH	MORTISE STOREROOM LOCKSET	8204 LNB C26D
1 EACH	DUMMY SET	8294 LNB C26D
1 EACH	MORTISE CYLINDER	BASE BUILDING KEYWAY
1 EACH	KEYING	KEYING BY OTHERS
2 EACH	DOOR CLOSER	1431 UO EN - SURFACE MOUNTED
2 EACH	KICKPLATE	8in X 34.5in C32D TAPE
2 EACH	FLOOR STOP	GSH 209 C26D
20 FEET	DOOR GASKET	S88 BLACK

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1 PAIR OF DOORS D104-1 EXTERIOR STORAGE LHR/RHRA
2/755 x 2260 x 45mm
HOLLOW METAL DOOR / HOLLOW METAL FRAME

6 EACH	HINGES	STANLEY CB168 4 1/2 X 4 C26D
2 EACH	FLUSH BOLT	F780 12in FIRE LABELED
1 EACH	MORTISE STOREROOM LOCKSET	8204 LNB C26D
1 EACH	DUMMY SET	8294 LNB C26D
1 EACH	MORTISE CYLINDER	BASE BUILDING KEYWAY
1 EACH	KEYING	KEYING BY OTHERS
2 EACH	DOOR CLOSER	1431 UO EN - SURFACE MOUNTED
2 EACH	KICKPLATE	8in X 34.5in C32D TAPE
2 EACH	FLOOR STOP	GSH 209 C26D
1 SET	WEATHERSTRIP	W15 X 2/84in X 1/72in
1 EACH	THRESHOLD	CT10 X 72in AL
20 FEET	DOOR GASKET	S88 BLACK

EXISTING DOOR D105 VESTIBULE LHR/RHR
EXISTING DOOR / EXISTING FRAME
NOTE:
EXISTING DOOR, FRAME AND HARDWARE TO REMAIN

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1 SGL DOOR D106-1 BACKSTAGE LH
1085 x 2140 x 45mm
HOLLOW METAL DOOR / HOLLOW METAL FRAME

3 EACH	HINGES	STANLEY CB168 4 1/2 X 4 C26D
1 EACH	MORTISE CLASSROOM LOCKSET	8237 LNB C26D
1 EACH	MORTISE CYLINDER	BASE BUILDING KEYWAY
1 EACH	KEYING	KEYING BY OTHERS
1 EACH	DOOR CLOSER	1431 UO EN - SURFACE MOUNTED
18 FEET	DOOR GASKET	S88 BLACK

---

1 SGL DOOR D107-1 EQUIPMENT STORAGE LH
1085 x 2134 x 45mm
HOLLOW METAL DOOR / HOLLOW METAL FRAME

3 EACH	HINGES	STANLEY CB168 4 1/2 X 4 C26D
1 EACH	MORTISE STOREROOM LOCKSET	8204 LNB C26D
1 EACH	MORTISE CYLINDER	BASE BUILDING KEYWAY
1 EACH	KEYING	KEYING BY OTHERS
1 EACH	KICKPLATE	8in X 34.5in C32D TAPE
1 EACH	FLOOR STOP	GSH 209 C26D
18 FEET	DOOR GASKET	S88 BLACK

---

1 SGL DOOR D108-1 BEFORE & AFTER CARE LH
914 x 2134 x 45mm
HOLLOW METAL DOOR / HOLLOW METAL FRAME

3 EACH	HINGES	STANLEY CB168 4 1/2 X 4 C26D
1 EACH	MORTISE CLASSROOM LOCKSET	8237 LNB C26D
1 EACH	MORTISE CYLINDER	BASE BUILDING KEYWAY
1 EACH	KEYING	KEYING BY OTHERS
1 EACH	DOOR CLOSER	1431 UO EN - SURFACE MOUNTED
1 EACH	KICKPLATE	8in X 34.5in C32D TAPE
1 EACH	FLOOR STOP	GSH 209 C26D
17 FEET	DOOR GASKET	S88 BLACK

---

1 SGL DOOR D109-1 CLASSROOM RH
914 x 2134 x 45mm
RELOCATED DOOR / WOOD FRAME

3 EACH	HINGES	STANLEY CB168 4 1/2 X 4 C26D
1 EACH	MORTISE CLASSROOM LOCKSET	8237 LNB C26D
1 EACH	MORTISE CYLINDER	BASE BUILDING KEYWAY
1 EACH	KEYING	KEYING BY OTHERS
1 EACH	DOOR CLOSER	1431 UO EN - SURFACE MOUNTED
1 EACH	KICKPLATE	8in X 34.5in C32D TAPE
1 EACH	FLOOR STOP	GSH 209 C26D
17 FEET	DOOR GASKET	S88 BLACK

NOTE:
RELOCATED DOOR ON NEW FRAME

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1 SLIDING DOOR D109-2 CLASSROOM RH
1650 x 2134 x 45mm
WOOD DOOR / FRAMELESS

1 EACH	SLIDING TRACK	C104 144in ALUMINUM
2 EACH	HANGERS	C911
1 EACH	GUIDE TRACK	C914 X 72in
1 EACH	GUIDE	C913
1 EACH	HOOK BOLT	MS1850SN-450-628 X 4001-628
1 EACH	THUMBTURN	CBM100-A-T1-28
1 EACH	MORTISE CYLINDER	BASE BUILDING KEYWAY
1 EACH	KEYING	KEYING BY OTHERS
1 EACH	EDGE PULL	GSH20 C26D
1 EACH	FLUSH PULL	GSH960 C26D
2 EACH	STOP	C100 TRACK MOUNTED

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1 PAIR OF DOORS D110 CORRIDOR RH ACTIVE
2/910 x 2134 x 45mm
HOLLOW METAL DOOR / HOLLOW METAL FRAME
3/4 HR Fire Label

6 EACH	HINGES	STANLEY CB168 4 1/2 X 4 C26D
2 EACH	FLUSH BOLT	F780 12in FIRE LABELED
1 EACH	MORTISE CLASSROOM LOCKSET	8237 LNB C26D
1 EACH	DUMMY SET	8294 LNB C26D
1 EACH	MORTISE CYLINDER	BASE BUILDING KEYWAY
1 EACH	KEYING	KEYING BY OTHERS
2 EACH	DOOR CLOSER	1431 UO EN - SURFACE MOUNTED
2 EACH	KICKPLATE	8in X 34.5in C32D TAPE
2 EACH	FLOOR STOP	GSH 209 C26D
20 FEET	DOOR GASKET	S88 BLACK

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1 PAIR OF DOORS D111-1 VESTIBULE
2/910 x 2140 x 52
ALUMINUM DOOR / ALUMINUM FRAME

NOTE:

WEATHERSTRIP BY ALUMINUM DOOR SUPPLIER

6 EACH	HINGES	BY FRAME SUPPLIER
2 EACH	FLUSH BOLT	F780 12in FIRE LABELED
1 EACH	HOOKBOLT DEADLOCK FOR ALUMINUM DOOR	MS1850S-110 628
1 EACH	MORTISE CYLINDER	BASE BUILDING KEYWAY
1 EACH	KEYING	KEYING BY OTHERS
2 SET	DOOR PUSH/PULL COMBINATION	GSH1180-1 X 5035-1 #5 MGT X #2 MGT C32D GSH111920
1 EACH	AUTO OPERATOR	P-OSFH-76
2 EACH	PUSH BUTTON	10PBR1
1 EACH	INSTALL CLOSER	INSTALL CLOSER WITH INACTIVE LEAF
1 EACH	RELAY SYSTEM	BECX-SA1
1 EACH	DOOR CLOSER	351 UO EN
1 EACH	DROP PLATE	351-D EN
2 EACH	OVERHEAD STOP	699S C26D CONCEALED

NOTE:

AUTHORIZED PERSONNEL HAS TO UNLOCK THIS DOOR PRIOR TO OPERATION OF AUTO DOOR OPERATOR.

1 PAIR OF DOORS D111-2 VESTIBULE
2/910 x 2140 x 52
ALUMINUM DOOR / ALUMINUM FRAME

NOTE:

WEATHERSTRIP BY ALUMINUM DOOR SUPPLIER

6 EACH	HINGES	BY FRAME SUPPLIER
2 EACH	FLUSH BOLT	F780 12in FIRE LABELED
1 EACH	HOOKBOLT DEADLOCK FOR ALUMINUM DOOR	MS1850S-110 628
1 EACH	MORTISE CYLINDER	BASE BUILDING KEYWAY
1 EACH	KEYING	KEYING BY OTHERS
2 SET	DOOR PUSH/PULL COMBINATION	GSH1180-1 X 5035-1 #5 MGT X #2 MGT C32D GSH111920
1 EACH	AUTO OPERATOR	P-OSFH-76
2 EACH	PUSH BUTTON	10PBR1
1 EACH	INSTALL CLOSER	INSTALL CLOSER WITH INACTIVE LEAF
1 EACH	RELAY SYSTEM	BECX-SA1
1 EACH	DOOR CLOSER	351 UO EN
1 EACH	DROP PLATE	351-D EN
2 EACH	OVERHEAD STOP	699S C26D CONCEALED

NOTE:

AUTHORIZED PERSONNEL HAS TO UNLOCK THIS DOOR PRIOR TO OPERATION OF AUTO DOOR OPERATOR.

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1 PAIR OF DOORS D112-1 STOCK RH ACTIVE
2/645 x 2140 x 45mm
HOLLOW METAL DOOR / HOLLOW METAL FRAME

6 EACH	HINGES	STANLEY CB168 4 1/2 X 4 C26D
2 EACH	FLUSH BOLT	F780 12in FIRE LABELED
1 EACH	MORTISE CLASSROOM LOCKSET	8237 LNB C26D
1 EACH	DUMMY SET	8294 LNB C26D
1 EACH	MORTISE CYLINDER	BASE BUILDING KEYWAY
1 EACH	KEYING	KEYING BY OTHERS
2 EACH	DOOR CLOSER	1431 UO EN - SURFACE MOUNTED
2 EACH	KICKPLATE	8in X 34.5in C32D TAPE
2 EACH	FLOOR STOP	GSH 209 C26D
20 FEET	DOOR GASKET	S88 BLACK

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1 SGL DOOR D112-2 STOCK LHR
900mm x 2140 x 45mm
HOLLOW METAL DOOR / HOLLOW METAL FRAME
3/4 HR Fire Label

3 EACH	HINGES	STANLEY CB168 4 1/2 X 4 C26D
1 EACH	MORTISE CLASSROOM LOCKSET	8237 LNB C26D
1 EACH	MORTISE CYLINDER	BASE BUILDING KEYWAY
1 EACH	KEYING	KEYING BY OTHERS
1 EACH	DOOR CLOSER	1431 UO EN - SURFACE MOUNTED
1 EACH	FLOOR STOP	GSH 209 C26D
17 FEET	DOOR GASKET	S88 BLACK

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1 SGL DOOR D113-1 BARRIER FREE WASHROOM RH
915mm x 2134 x 45mm
WOOD DOOR / WOOD FRAME

3 EACH	HINGES	STANLEY CB168 4 1/2 X 4 C26D
1 EACH	MORTISE PRIVACY SET	8265 LNB C26D
1 EACH	KICKPLATE	8in X 34.5in C32D TAPE
1 EACH	FLOOR STOP	GSH 209 C26D
17 FEET	DOOR GASKET	S88 BLACK

---

1 SGL DOOR D114-1 CLASSROOM LH
914 x 2134 x 45mm
WOOD DOOR / HOLLOW METAL FRAME

3 EACH	HINGES	STANLEY CB168 4 1/2 X 4 C26D
1 EACH	MORTISE CLASSROOM LOCKSET	8237 LNB C26D
1 EACH	MORTISE CYLINDER	BASE BUILDING KEYWAY
1 EACH	KEYING	KEYING BY OTHERS
1 EACH	DOOR CLOSER	1431 UO EN - SURFACE MOUNTED
1 EACH	KICKPLATE	8in X 34.5in C32D TAPE
1 EACH	FLOOR STOP	GSH 209 C26D
17 FEET	DOOR GASKET	S88 BLACK

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1 SGL DOOR D115-1 CLASSROOM RH
914 x 2134 x 45mm
WOOD DOOR / HOLLOW METAL FRAME

3 EACH	HINGES	STANLEY CB168 4 1/2 X 4 C26D
1 EACH	MORTISE CLASSROOM LOCKSET	8237 LNB C26D
1 EACH	MORTISE CYLINDER	BASE BUILDING KEYWAY
1 EACH	KEYING	KEYING BY OTHERS
1 EACH	DOOR CLOSER	1431 UO EN - SURFACE MOUNTED
1 EACH	KICKPLATE	8in X 34.5in C32D TAPE
1 EACH	FLOOR STOP	GSH 209 C26D
17 FEET	DOOR GASKET	S88 BLACK

---

1 SGL DOOR D116-1 CLASSROOM RH
914 x 2134 x 45mm
WOOD DOOR / HOLLOW METAL FRAME

3 EACH	HINGES	STANLEY CB168 4 1/2 X 4 C26D
1 EACH	MORTISE CLASSROOM LOCKSET	8237 LNB C26D
1 EACH	MORTISE CYLINDER	BASE BUILDING KEYWAY
1 EACH	KEYING	KEYING BY OTHERS
1 EACH	DOOR CLOSER	1431 UO EN - SURFACE MOUNTED
1 EACH	KICKPLATE	8in X 34.5in C32D TAPE
1 EACH	FLOOR STOP	GSH 209 C26D
17 FEET	DOOR GASKET	S88 BLACK

---

1 SGL DOOR D117A TEACHERS ROOM LH
885 x 2140 x 45mm
WOOD DOOR / HOLLOW METAL FRAME

3 EACH	HINGES	STANLEY CB168 4 1/2 X 4 C26D
1 EACH	MORTISE CLASSROOM LOCKSET	8237 LNB C26D
1 EACH	MORTISE CYLINDER	BASE BUILDING KEYWAY
1 EACH	KEYING	KEYING BY OTHERS
1 EACH	DOOR CLOSER	1431 UO EN - SURFACE MOUNTED
1 EACH	FLOOR STOP	GSH 209 C26D
17 FEET	DOOR GASKET	S88 BLACK

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1 SGL DOOR D117B — TEACHERS ROOM — RH
885 x 2140 x 45mm
WOOD DOOR / HOLLOW METAL FRAME

3 EACH	HINGES	STANLEY CB168 4 1/2 X 4 C26D
1 EACH	MORTISE CLASSROOM LOCKSET	8237 LNB C26D
1 EACH	MORTISE CYLINDER	BASE BUILDING KEYWAY
1 EACH	KEYING	KEYING BY OTHERS
1 EACH	DOOR CLOSER	1431 UO EN - SURFACE MOUNTED
1 EACH	FLOOR STOP	GSH 209 C26D
17 FEET	DOOR GASKET	S88 BLACK

---

1 SGL DOOR D118-1 — CLASSROOM — RH
914 x 2134 x 45mm
RELOCATED DOOR / WOOD FRAME

3 EACH	HINGES	STANLEY CB168 4 1/2 X 4 C26D
1 EACH	MORTISE CLASSROOM LOCKSET	8237 LNB C26D
1 EACH	MORTISE CYLINDER	BASE BUILDING KEYWAY
1 EACH	KEYING	KEYING BY OTHERS
1 EACH	DOOR CLOSER	1431 UO EN - SURFACE MOUNTED
1 EACH	KICKPLATE	8in X 34.5in C32D TAPE
1 EACH	FLOOR STOP	GSH 209 C26D
17 FEET	DOOR GASKET	S88 BLACK

NOTE:
RELOCATED DOOR ON NEW FRAME

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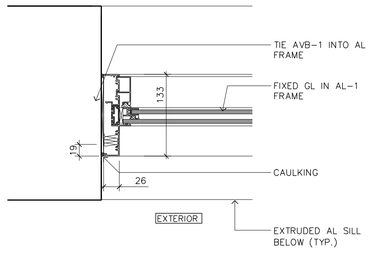
1 *Co-ordinate with Mechanical for plumbing fixtures*
2 *Co-ordinate with Electrical for built in power outlets and undercabinet light fixtures*
3 *Provide metal supports and spacers as specified and detailed on drawings*
4 *Provide Itemized Price*

Name	Room/Type		Finishes	Remarks
MW-109	*Classroom 109*	Activity Counter	**WD-1, SOL-1, BB-4B**	1,2
MW-110A	*Corridor 110A*	6' Coat Cubbies	**WD-1**	3
MW-110-1	*Corridor*	5' Coat Cubbies	**WD-1**	3
MW-110-2	*Corridor*	6' Coat Cubbies	**WD-1**	3
MW-114	*Classroom*	Activity Counter	**WD-1, SOL-1, BB-4B**	1,2
MW-114-1	*Classroom*	Shelving Unit	**WD-1, SOL-1**	4
MW-115	*Classroom*	Activity Counter	**WD-1, SOL-1, BB-4B**	1,2
MW-115-1	*Classroom*	Shelving Unit	**WD-1, SOL-1**	4
MW-116	*Classroom*	Activity Counter	**WD-1, SOL-1, BB-4B**	1,2
MW-116-1	*Classroom*	Shelving Unit	**WD-1**	4
MW-102A-1	*Girl's Change room*	Counter	**WD-2, SOL-2**	
MW-102A-2	*Girl's Change room*	Bench	**WD-2**	3
MW-102A-3	*Girl's Change room*	Counter	**WD-2, SOL-2**	
MW-102B-1	*Boy's Change room*	Counter	**WD-2, SOL-2**	
MW-102B-2	*Boy's Change room*	Bench	**WD-2**	3
MW-119A	*Collaborative Space*	Seating pod	**WD-3**	3
MW-119B	*Collaborative Space*	Seating pod	**WD-3**	3
MW-119C	*Collaborative Space*	Seating pod	**WD-3**	3
MW-119	*Collaborative Space*	6' Coat Cubbies	**WD-1**	3

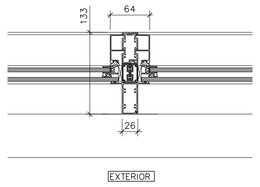
End of Schedule

ALUMINUM FRAME PROFILES - SULL SASH WINDOW

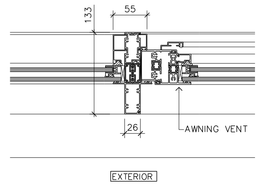
ALF-3A WINDOW JAMB



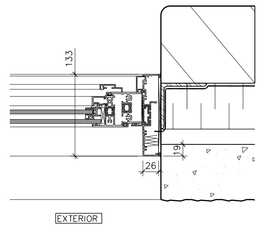
ALF-3B WINDOW MULLION



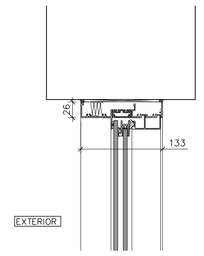
ALF-3C T/H OPERABLE WINDOW MULLION



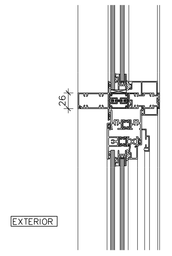
ALF-3D T/H OPERABLE WINDOW JAMB



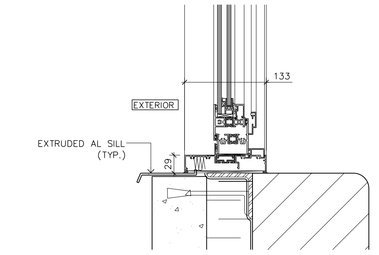
ALF-3E WINDOW HEAD



ALF-3F T/H OPERABLE WINDOW FIXED WITH



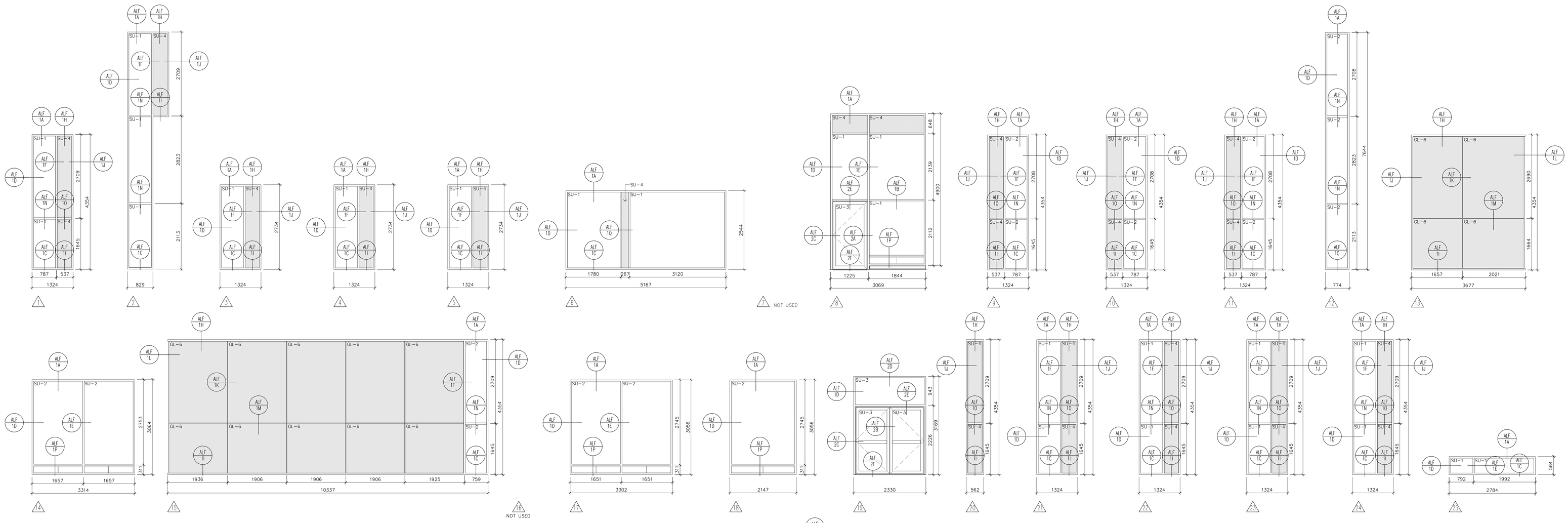
ALF-3G T/H OPERABLE WINDOW SILL



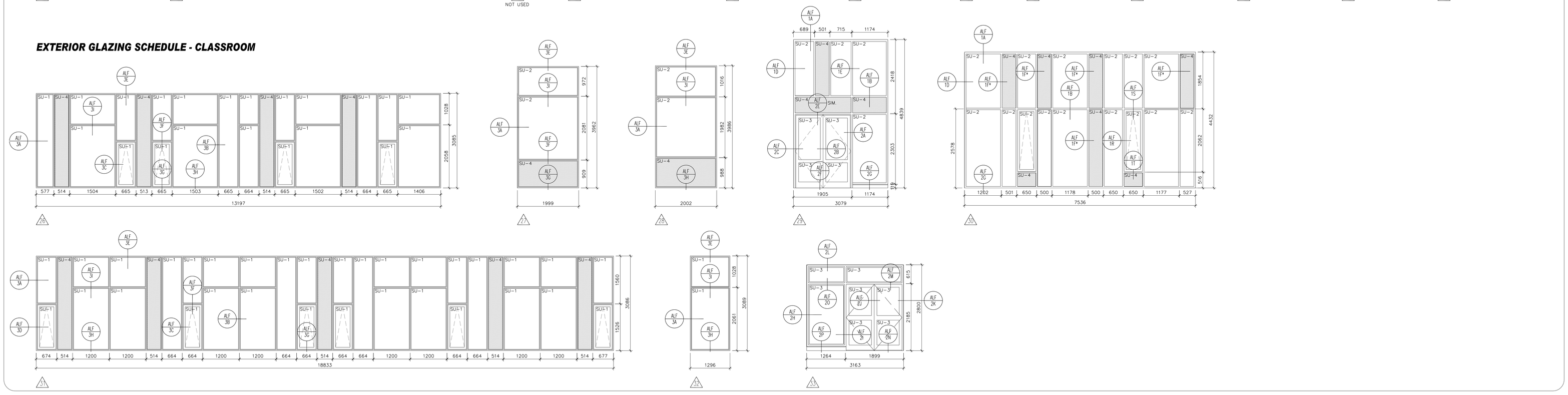
ALF-3H WINDOW SILL

ALF-3I HOR. WINDOW MULLION

EXTERIOR GLAZING SCHEDULE - GYMNASIUM



EXTERIOR GLAZING SCHEDULE - CLASSROOM



GENERAL NOTES :

1. These Contract Documents are the property of the Architect. The Architect bears no responsibility for the misinterpretations of these documents by the Contractor. Upon written application the Architect will provide written / graphic clarification or supplemental information regarding the intent of the Contract Documents. The Architect will review Shop Drawings submitted by the Contractor for design conformance only.

2. Drawings are not to be scaled for construction. Contractor to verify all existing conditions and dimensions required to perform the Work and report any discrepancies with the Contract Documents to the Architect before commencing work.

3. Positions of exposed or finished mechanical or electrical devices, fittings, and fixtures are indicated on the Architectural drawings. The locations shown on the Architectural drawings govern over the Mechanical and Electrical drawings. Those items not clearly located will be located as per directed by the Architect.

MATERIAL LEGEND:

- BRICK (BR)
- PRECAST
- STEEL (STL)
- ALUMINUM (AL)
- RIGID INSULATION
- FOAM INSULATION
- SEMI-RIGID INSULATION
- BATT INSULATION
- ACOUSTICAL PANELS
- CONCRETE (CONC)
- CONCRETE BLOCK (CONC BLK)
- STONE OR CERAMIC
- CONT'S BLOCKING
- INTERMITTENT BLOCKING
- GYPSUM BOARD (GB)
- FINISH WOOD (WD)
- FIBREBOARD
- PLYWOOD
- GLASS (GL)
- WOOD VENEER

GLAZING LEGEND:

- X – FRAME TYPE
- # – FRAME PROFILE
- WINDOW NUMBER

Taylor_Smyth architects
345 Davenport Road
Suite 300, Toronto
Ontario M5R 1K1
t. 416.964.6688
f. 416.968.7728

CONTRACTOR MUST CHECK AND VERIFY ALL DIMENSIONS AND JOB SITE CONDITIONS AND REPORT ANY DISCREPANCIES TO THE CONSULTANT PRIOR TO COMMENCING CONSTRUCTION. ALL DRAWINGS AND SPECIFICATIONS AND COPIES THEREOF FURNISHED BY THE ARCHITECT ARE AND SHALL REMAIN THE PROPERTY OF THE ARCHITECT AND MUST BE RETURNED UPON REQUEST. USE THE LATEST REVISED DRAWINGS ONLY. REPRODUCTIONS OF DRAWINGS AND RELATED DOCUMENTS IN PART OR IN WHOLE IS FORBIDDEN WITHOUT TDSB'S WRITTEN PERMISSION. DRAWINGS TO BE READ IN CONJUNCTION WITH SPECIFICATIONS DO NOT SCALE DRAWINGS.

No.	DATE	DESCRIPTION
1	09/29/2011	ISSUED FOR ADDENDUM NO.1

ONTARIO ASSOCIATION OF ARCHITECTS — R. Smyth — REGISTERED WITH LICENCE 4677

NORTH

Toronto District School Board

Facility Services Department
Design & Construction Division
15 Oakburn Cres. Toronto, Ontario M2N 2T5
t. 416-395-4588 / f. 416-395-9734

LOCATION

CEDARVALE COMMUNITY SCHOOL

145 AVA RD.
YORK, ONTARIO

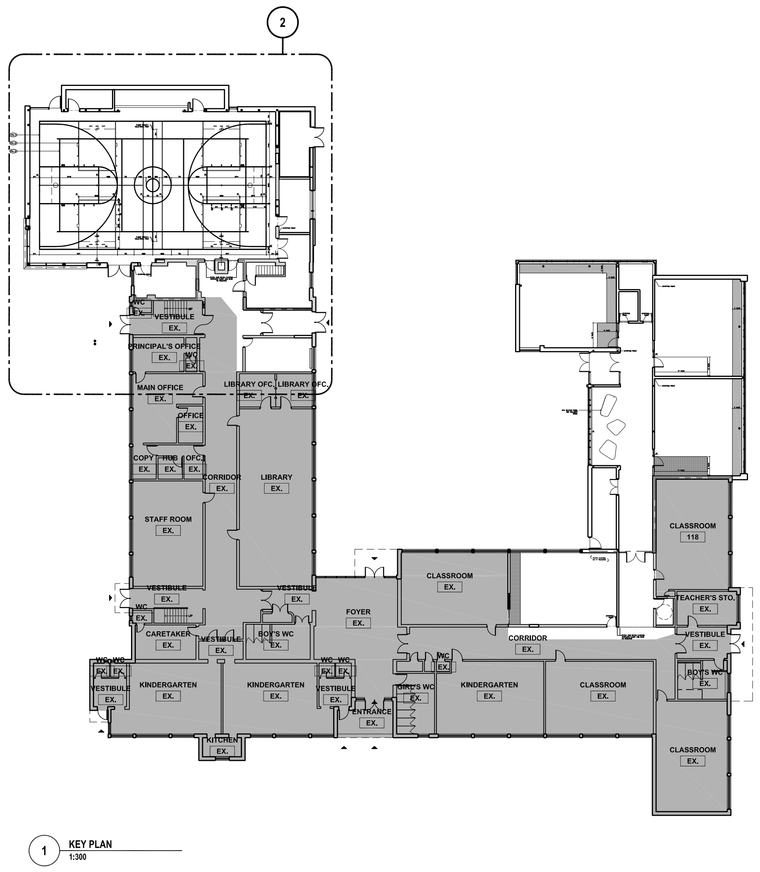
PROJECT

CEDARVALE CLASSROOM AND GYMNASIUM ADDITION

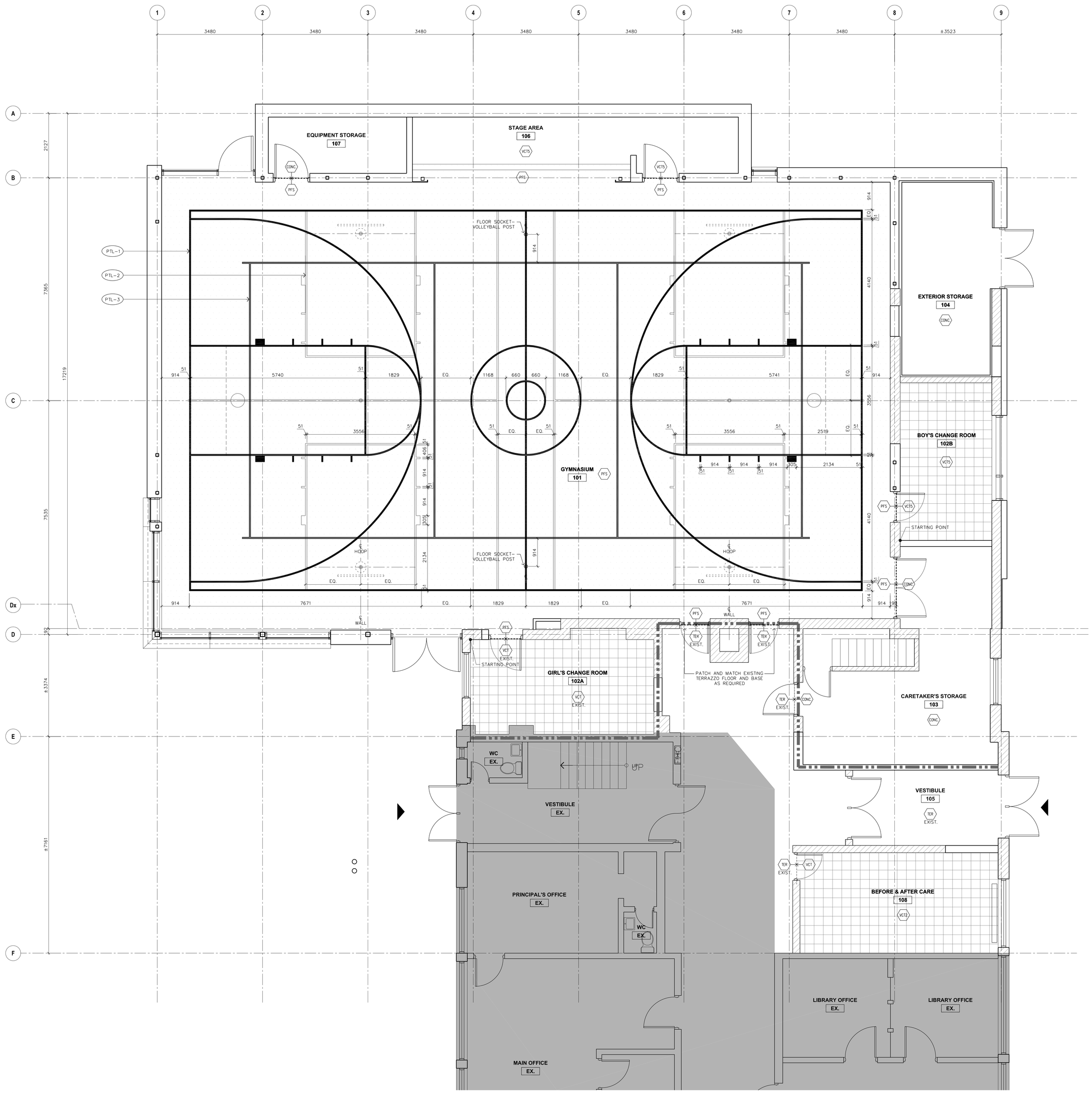
DRAWING TITLE

AL FRAME PROFILES, GLAZING SCHED.

TDSB PROJECT No: 1108	DRAWING No
DATE: September 2011	
SCALE:	A0.05
DRAWING BY: AA	
APPROVED BY:	



1 **KEY PLAN**
1:500



2 **FLOOR FINISH PLAN - GYMNASIUM**
1:50

Taylor_Smyth **architects**

345 Davenport Road
Suite 300, Toronto
Ontario M5R 1K1
t. 416.968.6688
f. 416.968.7728

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LEGEND:

- EXIST. — EXISTING FLOOR FINISH
- VC1 — VINYL COMPOSITION TILE–COLOUR 1
- VC12 — VINYL COMPOSITION TILE–COLOUR 2
- VC13 — VINYL COMPOSITION TILE–COLOUR 3
- VC14 — VINYL COMPOSITION TILE–COLOUR 4
- VC15 — VINYL COMPOSITION TILE–COLOUR 5
- VCT EXIST. — EXISTING VINYL COMPOSITION TILE
- CONC — SEALED CONCRETE
- EPX — EPOXY FLOORING
- TER — TERRAZZO
- PFS — POLYURETHANE FLOORING SYSTEM
- PTL–1 — PRIMARY BASKETBALL LINES
- PTL–2 — SECONDARY BASKETBALL LINES
- PTL–3 — VOLLEYBALL COURTLINES
- FLOOR TRANSITION STRIP

CONTRACTOR MUST CHECK AND VERIFY ALL DIMENSIONS AND JOB SITE CONDITIONS AND REPORT ANY DISCREPANCIES TO THE CONSULTANT PRIOR TO COMMENCEMENT OF WORK. ALL DRAWINGS, SPECIFICATIONS AND RELATED DOCUMENTS ARE THE COPYRIGHT PROPERTY OF TDSB AND MUST BE RETURNED UPON REQUEST. USE THE LATEST REVISED DRAWINGS ONLY. REPRODUCTIONS OF DRAWINGS AND RELATED DOCUMENTS IN PART OR IN WHOLE IS FORBIDDEN WITHOUT TDSB'S WRITTEN PERMISSION. DRAWINGS TO BE READ IN CONJUNCTION WITH SPECIFICATIONS. DO NOT SCALE DRAWINGS.

No.	DATE	DESCRIPTION
1	09/29/2011	ISSUED FOR ADDENDUM NO. 1

ONTARIO ASSOCIATION OF ARCHITECTS — R. Smyth — LICENCE 4677

NORTH

Toronto District School Board

Facility Services Department
Design & Construction Division
15 Oakburn Cres. Toronto, Ontario M2N 2T5
t. 416-395-4588 / f. 416-395-9734

LOCATION

CEDARVALE COMMUNITY SCHOOL

145 AVA RD.
YORK, ONTARIO

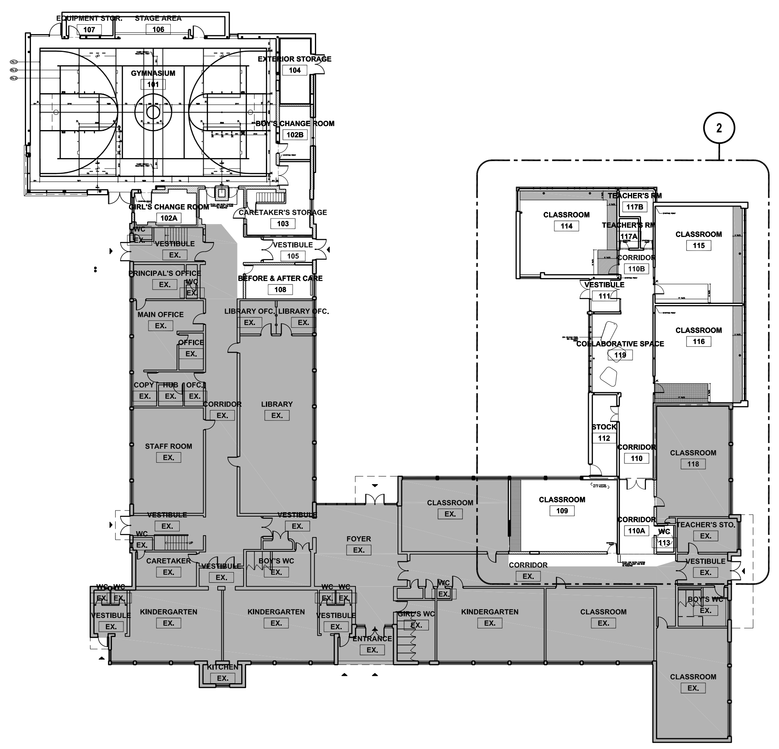
PROJECT

CEDARVALE CLASSROOM AND GYMNASIUM ADDITION

DRAWING TITLE

FLOOR FINISH PLAN – GYM

TDSB PROJECT No: 1108	DRAWING No
DATE: September 2011	
SCALE: AS NOTED	A2.05
DRAWING BY: AA	
APPROVED BY: RS	



1 KEY PLAN
1:300

2 FLOOR FINISH PLAN - CLASSROOM ADDITION
1:50

Taylor_Smyth architects

345 Davenport Road
Suite 300, Toronto
Ontario M5R 1K1
t. 416.968.6688
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general notes :

1. These Contract Documents are the property of the Architect. The Architect bears no responsibility for the misinterpretations of these documents by the Contractor. Upon written application the Architect will provide written / graphic clarification or supplemental information regarding the intent of the Contract Documents. The Architect will review Shop Drawings submitted by the Contractor for design conformance only.

2. Drawings are not to be scaled for construction. Contractor to verify all existing conditions and dimensions required to perform the Work and report any discrepancies with the Contract Documents to the Architect before commencing work.

3. Positions of exposed or finished mechanical or electrical devices, fittings, and fixtures are indicated on the Architectural drawings. The locations shown on the Architectural drawings govern over the Mechanical and Electrical drawings. Those items not clearly located will be located as per directed by the Architect.

LEGEND:

EXIST	EXISTING FLOOR FINISH
VCT1	VINYL COMPOSITION TILE–COLOUR 1
VCT2	VINYL COMPOSITION TILE–COLOUR 2
VCT3	VINYL COMPOSITION TILE–COLOUR 3
VCT4	VINYL COMPOSITION TILE–COLOUR 4
VCT5	VINYL COMPOSITION TILE–COLOUR 5
VCT EXIST	EXISTING VINYL COMPOSITION TILE
CONC	SEALED CONCRETE
EPX	EPOXY FLOORING
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